The barracuda (Sphyraena barracuda) is a master predator armed with a double row of teeth, small razor-sharp teeth run in a row on the outside of the jaw with a second set of dagger-like teeth arranged in an arcade inside the mouth. Seldom can prey escape the vice-like grip as the teeth close into holes on the opposite jaw. Divers in the Indian Ocean off our coast do well to respect these torpedo-like fish.
RARE IS REWARDING

If you spot a Narina Trogon, consider yourself among a fortunate few. It’s one of Africa’s most elusive birds – a rare breed indeed. Like graduate professionals. Which is why PPS, with our rare insight into the graduate professional world, acknowledges and rewards the achievement of being one. As a PPS member, you benefit not only from financial services exclusively available to graduate professionals, but also from our unique PPS Profit-Share Account. Rare achievements deserve reward. Contact your PPS-accredited financial adviser or visit pps.co.za to see if you qualify.
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It is indisputable that Oral Health is a significant contributor to general health and wellbeing. Oral health conditions affect almost two-thirds of the world population throughout the course of life. It is hence imperative that this important public issue, Oral Health, be placed high on national policy agendas. In so doing, the required resources can be mobilised to support strategic orientations and priority actions aimed at reducing the effects of poor Oral Health on the wellbeing of the population. Good Oral Health impacts on the individual's ability to enjoy life activities, such as eating, swallowing, smiling, tasting, kissing and smelling. These activities contribute to the enjoyment of life, quality of life and general wellbeing.

The papers published in recognition of the Theme sought to highlight the critical role that Oral Health professionals could play in ensuring the optimal Oral Health and wellbeing of their patients. As a prologue, we conceptualised wellbeing as a critical dimension of health and related quality of life. This radical paradigm shift from an inadequate medical definition towards a comprehensive understanding of health and its determinants supports a worldwide consensus to move beyond a normative view of health and to incorporate the subjective aspirations of our patients. Throughout this series of publications, we defined Oral Health as a fundamental component of general health and wellbeing. Using this multidimensional concept, we evaluated the perceptions held by patients about the impact of oral diseases and conditions on their functional, social and psychological wellbeing.

Hence our conclusions and recommendations for Oral Health professionals to increase their appreciation of psychosocial and functional dimensions of Oral Health.

Below is a summary of key findings and recommendations from four articles published in this series. The Guest Editorial highlighted the need to embrace the broad the definition of Oral Health and its clinical implications. In so doing practitioners may begin to appreciate and integrate the expectations of patients regarding the care they receive. Evidence indicates that Oral Health professionals have the clinical competence to restore the function and aesthetics of diseased oral and dental structures. However, most practitioners are unable to account for the social and psychological consequences of treatment they offer to patients. To that end, a new breed of dentists must be developed, having impeccable technical and excellent social skills. This means that dental schools must reorient their teaching and learning philosophies to include social determinants of health and their contextual implications for care.

As part of the re-engineering of health care, the NHI provides an opportunity to incorporate social determinants as part of treatment planning, management of oral diseases and reimbursement. The proposed scheme prioritises socially disadvantaged patients, and seeks to incentivise clinicians who incorporate this dimension into their patient management regimen. It is therefore prudent for Oral Health professionals to be capacitated in preparation for the rollout of NHI.

The second paper was a review of Obstructive Sleep Apnoea (OSA), a condition characterised by multiple episodes of apnoea and hypopnoea due to collapsed airway. OSA is a relatively high prevalence condition with serious effects on the quality of life of the patient. This
trilogy of dysfunctions includes impairment of daytime alertness, of cognitive function and overall enjoyment and quality of life. While specialist medical examinations is required for an objective diagnosis of OSA, dentists are well positioned to suspect, screen, refer and co-manage these patients. The rising levels of diabetes and obesity in South Africa makes OSA arguably the most underdiagnosed, undertreated condition that continues to “erode health over time”.11 Hence there is a compelling case made by the authors that the Oral Health profession cannot remain uninvolved in dealing with this silent public health problem. Dental schools should offer curriculated and professional developmental modules to enable dentists to better manage patients affected by OSA. The use of oral devices by dentists in the management of OSA should be increased, as these interventions have been proven to improve clinical outcomes and patient wellbeing; as well as prolong life and perhaps save marriage.12

The third study, the national household survey was aimed at determining the association between psychosocial wellbeing and Oral Health. We found that South Africans perceived their wellbeing as moderately satisfactory, (6/10). This positive psychosocial state was associated with an increased number of dental visits and good oral hygiene.7 In our conclusion we assert that dentists should assist patients to achieve and maintain good oral hygiene, thereby greatly improving their subjective wellbeing.

The final paper in this series correlated malocclusion and wellbeing.9 Malocclusion was found to have a significant impact on the dental self-confidence of patients, 18 years and younger. In older patients the effect of malocclusion was significant on the social subscale. Unlike the popularly held belief, the impact of malocclusion on psychological wellbeing was found in our study to be higher in males and older patients. Dentists should therefore make special efforts to accommodate these patient groupings, by providing specific and appropriate treatment options.

The timing of this year’s SADA Theme was most fitting as it coincided with the groundbreaking adoption of a contemporary and comprehensive definition of oral health by delegates at the 104th World Dental Federation Congress. It is envisaged that as this process continues, relevant measurement tools will be developed to facilitate global comparisons. While it is still early days, we anticipate that this “new” definition of Oral Health will improve clinical practice and place the interests and expectations of patients at the centre of clinical dental care.

References
As the year 2016 comes to an end, a major change in leadership has been ushered in at SADA Head office. We are pleased to welcome our new Chief Executive Officer (CEO), Mr Khomi Climus Makhubele. “KC” (as he likes to be called), will commence official duties on 1 November 2016, responsible for management and administration of the Association. He is currently the Managing Executive: Marketing and Strategic Relationships and Sales at Quest/Kelly Staffing Solutions. Mr Makhubele registered as a student studying Medicine [MBChB] at the University of Cape Town, but sadly, financial constraints prevented his continuing beyond third year. His academic commitment was not to be denied, however, and he now holds a series of qualifications, amongst others a Diploma in Ministerial Studies, His People Bible School (1991); Diploma in Management Theory and Practice, ICM, UK (1996); Diploma in Human Resources Management, Damelin (1996); Diploma in Manager Development, Damelin (1996); Diploma in Human Resources Management, ICM, UK (1997); Diploma in Business Management and Marketing, Damelin School of Management (1999); BCom (Business Management and Marketing) Oxford Brookes University, UK (2001); Master of Business Administration (MBA) from De Montfort University, UK (2005); •Executive Development Programme, University of the Witwatersrand (2015).

Mr Makhubele has extensive experience in management and has held several positions as CEO, General Manager, Managing Director and Divisional Director of private companies and educational institutions. He also worked tirelessly to unite The Federation of African Professional Staffing Organisations (APSO) into a leaner and wellfunctioning Association.

He has worked in private sector education, professional associations and personnel consultancy groups in the private sector. While KC is not qualified as a dentist, he does bring a wealth of management and professional association experience. He was initially introduced at the SADA National Council meeting held on 7 October 2016 when he had the opportunity of meeting with Board Members and members of National Council. He was very grateful for the experience whilst he sat in for part of the meeting, gaining insight into issues debated affecting the profession and members. KC will also participate in the next round of Board sub-committee meetings in early November 2016 and participate in his first Board meeting in the last week of November 2016.

His arrival and assumption of office are warmly anticipated.

MEDICAL SCHEMES REPORT

It has been widely reported in the press that medical schemes are contemplating steep rises in contributions for 2017, averaging 10 percent with some options escalating as high as 17%, due to a huge increase in claims for medical services this year. The Council for Medical Schemes (CMS) Report 2015-2015 states that the number of medical schemes remained at 83 and observes that for the past 15 years increases in medical scheme contributions have been on average almost four percentage points above inflation. The report also shows that claims against medical savings account increased by 13.4 percent, suggesting that schemes have changed their benefit options so that a greater proportion of benefits are now funded from these savings accounts. The largest proportion of claims paid is for hospital expenses. At the same time it is of considerable concern that the number of persons belonging to medical schemes has declined from 8.814 million to 8,809 million. a 0.06 percent decline.

P Govan: Acting CEO of SADA, E-mail: pgovan@sada.co.za
The total healthcare benefit paid from medical schemes risk pools and savings accounts of members increased by 9.0% from R127.2 billion in 2014 to R138.6 billion in 2015.

Payments to dentists decreased from 3.0% in 2013 to 2.4% in 2014 and 2.3% in 2015. Average payments to dentists per event for 2014 were R817.19 (specialists R1061.71) and R867.67 (specialists R1139.35) for 2015. In addition, 5.5% was paid to dentists from risk pools whilst 8.6% was paid from savings accounts. Medicines took the largest share of 36.1% and supplementary and allied health professionals accounted for 16.8% of benefits paid from savings account.

The patient utilisation of dentists decreased from 2.11 (2015) to 2.10 (2014), and the average amount paid to dentists per visit from risk benefit was R323.48 in 2015, up from R318.83 in 2014. Payments from medical savings accounts were R537.62 in 2015, up from R489.64 in 2014.

Medical Schemes will in 2017 adopt two strategies to contain costs. Firstly there will be a channelling of members into using particular healthcare providers, which will be effected in one of two ways: either enacting scheme rules which compel members to use particular providers or offering members lower contributions (Efficiency Discounted Options :EDOs) if they agree to use particular providers. Schemes also intend to better manage high risk members, particularly those who have two or more medical conditions. Prescribed Minimum Benefits (PMB) members will be required to use designated service providers (DSPs) as part of managed care arrangements.

Schemes must obtain permission from CMS to launch EDOs because, technically, the Medical Schemes Act will be violated as it provides that members belonging to the same option must pay the same contributions The CMS will allow the EDO option if the scheme can prove it followed a transparent process when selecting service providers for the CDO and that the cost saving will be passed on to members in the form of lower contributions.

Seven open schemes such as Discovery, Bonitas, Medical Fund, Momentum Health, Medshield, Bestmed and Fedhealth and including the largest closed scheme, GEMS, will introduce EDOs. Some schemes plan to have six EDOs, saving individual members between R300 to R350.00 per month.

EMERITUS MEMBERS
The SADA Board is pleased to announce that after representations from this membership category were considered, the privileges of Emeritus Membership have been reinstated. Hence, this peer group will not be required to pay for SADA membership fees for 2017. This privilege is available to those members who have already reached 70 years of age at the start of the Association’s financial year (i.e.1st October) as from 2016. The full benefits of Emeritus membership were comprehensively outlined in the communique sent to members in this category, who are invited to contact the SADA offices for clarity.
New SADA CEO, Welcome Mr K C Makhubele

Mr. KC Makhubele, a Transformational Speaker, is currently a Managing Executive: Marketing and Strategic Relationships of Kelly & Quest. He is responsible for the Marketing and Strategic Relationships as well as growing the company brand and market share. Board Director & President at The Federation of African Professional Staffing Organisations (APSO) and Council Member at South African Chamber of Commerce and Industry (SACCI) and the Confederation of Associations in the Private Employment Sector. He holds positions of Board Director at Khulisa Social Solutions NPC, President and Board Director at Imagine2morrow NPC.

Previous positions
He has previously held various positions as Managing Director (Empvest and Bathusi), Divisional Director (Primeserv Group), General Manager (Damelin Braamfontein and Quest) and Chief Operating Officer (Khulisa Social Solutions). He has a passion for youth skills development and deployment has contributed to this in various roles in Khulisa, Damelin and as President of the Student Christian Fellowship (UCT) and as a Youth Pastor at the Apostolic Faith Mission church of South Africa (Daveyton).

Membership
Mr Makhubele is a member of the Black Management Forum and the International Crans Montana Forum of New Leaders for Tomorrow. He previously sat on the committee of Business Processing Enabling South Africa (BPeSA) & Labour Chamber of the SERVICES SETA.

Qualifications
His qualifications includes an MBA (De Montfort University-UK), B Com, Marketing & Business Management (Oxford Brookes University-UK), Diploma in Business Management and Marketing (DMS), Diploma in Human Resources (ICM, UK) and Diploma in Ministerial Studies (His People Bible School). He is currently registered towards an M Com (Unisa).
Editorial Assistant Edith Dube says good bye

Edith has left the Journal team... she departed from the Association at the end of October... and has created a considerable gap, even though this is at least partially plugged by her remarkable achievements and contributions as the Editorial Assistant these past several years. She arrived at Head Office bringing with her a background in publishing, for she had previously handled a journal for the mining industry. That experience was put to work at once and it was not long before Edith had effected many changes and streamlined much of our publishing processes. As she gained in an understanding of the esoteric requirements of a dental journal so Edith was able to assume an enhanced role and contributing authors – and the Editor! ...benefitted by her prompt attention, her detailed follow through and her always helpful reaction, accompanied by a cheerful chuckle and a warm greeting.

The name Edith has roots in Old English, coming from two words.. “ead” meaning riches or blessed, and “gyo”.. which strangely enough means war. So Edith brought a strength to the management of the Journal, which in turn was itself blessed. In Lithuanian, the name is spelt “Edita”, whilst in Hungarian it is “Edit”... somewhat appropriate for the task she handled at the Association.

Edith has returned to a previous interest and has an appointment with an Employment Agency, to which she will certainly bring her considerable talents and unbounding enthusiasm.

We wish her every success.
Determining an average distance from the external mandibular cortex to the inferior alveolar canal using cone beam computed tomography (CBCT) imaging: An aid to harvesting mandibular ramus autogenous grafts.

**SUMMARY**

**Objectives:** To provide average measurements relating the external mandibular cortex (EMC) to the inferior alveolar canal (IAC) using CBCT.

**Methods:** 100 CBCT images from UWC Dental hospital patient database were analysed using CBCT software (NewtomVGi Image works Corps) to produce coronal slices at four defined points along the IAC. Each point was measured from the IAC to the outer aspect of the mandibular buccal cortex and to the alveolar ridge crest (edentulous mandibles) or buccal cortical plate crest (dentate mandibles). The paired t-test was used to analyse right and left side measurements in order to test for differences in right and left side means.

**Results:** A mean width of 5.891mm (±1.09) from the IAC to the EMC in the horizontal plane and a mean height of 13.068mm (±2.963) from IAC to the alveolar crest or buccal cortical plate was demonstrated. Mean height was lower in edentulous mandibles (11.142mm in females; 13.490mm in males) than in dentate mandibles (12.916mm in females; 14.102 in males). There was no significant difference in width values. Height values were greater in males (14.102mm) than in females (12.916mm), being marginally significant (p-value of 0.00948:p<0.05).

**Conclusions:** These measurements are clinically applicable when harvesting mandibular autogenous block grafts.

**Keywords:** CBCT; Autogenous ramus grafts, inferior alveolar nerve

Autogenous grafting in combination with the placement of dental implants are commonplace procedures, as first described by Brånemark and colleagues.1 The mandibular ramus is the preferred intra-oral donor site, but the challenge to harvest an adequate quantity of bone with minimal risk of associated complications remains – particularly the risk of injury to the inferior alveolar nerve.

Measurements that are available in the literature have been derived in general from studies that use dry mandibles and from those that use harvested grafts; or otherwise have been applied to procedures other than grafting, such as sagittal split osteotomies.3-7

The advent of CBCT has greatly improved diagnostic imaging in the cranio-facial region. It not only allows accurate image production with reliable visualisation of the inferior alveolar nerve canal, but its application also facilitates accurate measurements of alveolar bone.8-10

Clinically, application of these average values quantifying the location of the inferior alveolar nerve to the outer cortex of the mandible, in terms of height and width, will be invaluable in the prevention of untoward complications. This study uses cone-beam computed tomography (CBCT) to provide such average values.
METHODS AND MATERIALS

A consecutive sample of 100 CBCT images of patients were obtained from the patient database of the Tygerberg Dental Hospital, University of the Western Cape. Ethical approval for the study was obtained from the University of the Western Cape Faculty and Senate Research Committees. The scans had been taken previously for diagnostic purposes, independent of this study. Anonymity of the patient was ensured as the patient image was allocated a number. Only the age and sex of the patient was recorded against the allocated number.

The unit information, technical settings and parameters had been set according to manufacturer specifications. Criteria for inclusion were patients above the age of 18 years (the age of complete development of the mandible).11 Patient images were excluded from the study if the outer mandibular cortex and course of the inferior alveolar canal could not be clearly identified on the image or the image presented with impacted third molars, which resulted in distortion of reference points. The images of patients who had sustained trauma or presented with bony pathology that resulted in distortion or deformation of the mandibular anatomy (e.g. benign or malignant mandibular tumours), or of patients who had a history of previous maxillofacial surgery to the mandible in the vicinity of the inferior alveolar canal (e.g. patients with a history of bilateral sagittal split osteotomy, or who have had reconstruction plates placed), were also excluded.

The sample size was calculated from a test study. At n=100 the standard error of the estimated mean was calculated to be 0.202 and the 95% confidence interval for the true mean was predicted to be approximately (M—0.40,M+0.40), where M is the observed mean. The values were thus taken from 100 CBCT images.

CBCT software (Newtom VG® Image works Corps with QR-NNT® analysis software), was employed by a clinician to enhance visualisation of the inferior alveolar nerve and produce coronal slices at four defined points along the length of the inferior alveolar canal.

Each slice was set with a thickness of 1mm. The four points were defined at 10mm intervals anteriorly from the maximum convexity of the anterior border of the mandibular foramen (sections were made at points 10mm, 20mm, 30mm and 40 mm anterior to the mandibular foramen).

CBCT software (Newtom VG® Image works Corps with QR-NNT® analysis software), was employed by a clinician to enhance visualisation of the inferior alveolar nerve and produce coronal slices at four defined points along the length of the inferior alveolar canal.

CBCT software (Newtom VG® Image works Corps with QR-NNT® analysis software), was employed by a clinician to enhance visualisation of the inferior alveolar nerve and produce coronal slices at four defined points along the length of the inferior alveolar canal.

The results were captured on the data collection sheet and values were transferred to a spreadsheet (Microsoft Excel®). Data were analysed using a standard statistic programme (Statistics R:R development Core Team 2013. R Foundation for Statistical Computing, Vienna, Austria; URL http://www.R-project.org/). The paired t-test was used to analyse right and left side measurements in order to test for differences in the means of the right and left sides.

RESULTS

Table 1 below summarises the mean values from both left and right sides as well as the means of the combined values. Values that lay at or beyond the mental foramen were excluded from the overall mean calculations as these areas would be unsuitable for grafting. The paired t-test demonstrated that none of the differences between the means (between WL and WR, and between HL and HR) were found to be statistically significant (P <0.05). Figure 6 represents a plot of measurements for the widths on the right side (WR) matched with the widths on the left side (WR vs. WL) at the 10mm slice. As is apparent with this plot and similar plots at 20mm, 30mm and 40mm, the left and right side readings are not independent. Thus it was possible to combine left and right side results by obtaining the means of the pairs of every subject, consequently calculating summary statistics of these pairwise means. This is shown in Table 3.
The dependence of the overall combined mean width (see Table 2) on factors Edentulous (E)/Dentate (D) and Male (M)/Female (F) was examined by fitting a linear model with these factors and applying the combined mean width as the dependent variable. The results showed no significant effects of the factors.

This was similarly done for the overall combined height (see Table 2), with the combined mean height as a dependent variable. The means of the combined mean heights in the four categories are represented in Table 3.

The results of fitting the linear model indicated no interaction of the two factors. Fitting the model with no interaction gives the result shown in the following table (Table 4):

The H.all mean values (overall combined height) are greater for males than for females as shown by the positive co-efficient (2.647) for males in Table 4. This result is statistically significant (P-value<0.001). The effect of E on H.all shows that the value in edentulous patients is smaller, being marginally significant.

**DISCUSSION**

The mandibular ramus is the preferred donor site when harvesting autogenous bone for the purpose of ridge augmentation, particularly owing to the higher risk of complications that are associated with symphyseal grafts.\(^2\)\(^,\)\(^\text{12}\) During graft procedures, a lesser quantity of bone can be harvested from the ramus region than from the symphysis region due to anatomical limitations.\(^1\)\(^3\)\(^,\)\(^\text{14}\) It is recommended that a larger graft volume should be harvested than is required, so as to compensate for any resorption that may occur.\(^\text{14}\) Reports of resorption in volume are varied, ranging from volume 0%-46%.\(^\text{15}\)\(^-\)\(^\text{17}\) This study aimed to provide average values that relate the inferior alveolar canal to the external cortex of the mandible, in the region of the mandible from which autogenous grafts are harvested. Knowledge of average values, as provided in our study, may prove useful in affording a greater thickness of bone that could potentially be harvested from the ramus. It would be ideal to harvest a graft that incorporates both adequate thickness and volume.

The widths (from the mandibular canal to the crest of the alveolar ridge) and the heights (from the external cortex to the mandibular canal in the horizontal plane) were measured at the four defined points along the canal. Our results reflected an average bone width of 5.891mm (±1.09) from the nerve canal to the outer cortex. The thickest amount of bone was found at the points representing 20mm and 30mm anterior to the mandibular foramen, measuring 6.21 mm and 6.53mm respectively.
During the harvest procedure as described by Misch, four osteotomies are made and are referred to as the external oblique, the superior ramus, anterior body and inferior osteotomies (Figure 7).

The external oblique cut, as described by Misch, commences where adequate thickness develops, made 3 to 5 mm medial to the external oblique ridge. The findings of this study are of particular significance during site mapping of these procedures, indicating adequate thickness to be present between the points representing 20mm and 30mm.

There have been several studies which attempt to provide parameters for a ‘safe-zone’ for surgical procedures in the mandibular ramus region. These attempts have been performed using cadaver mandibles, as well as on live patients from harvested grafts. Values that are often referenced in both maxillofacial (for bilateral sagittal split osteotomy procedures) and in dental implant literature are from a study performed by Rajchel. Those authors found that the bone adjacent to the inferior alveolar nerve was thickest in the first molar region of the mandible with a mean dimension of 5.95mm (4.05mm cancellous bone thickness and 1.9mm cortical bone thickness). Their results indicated that the safest zone lies in the first and second molar area. One must consider that their study was performed on 45 dry cadaveric mandibles. Shrinkage associated with the dry specimen is a plausible explanation for the discrepancy between Rajchel’s findings and the results of this current study.

Another study investigating such values was conducted by Leong and co-workers, who provide values on cortical thickness taken from harvested grafts. In their study, the thickness of the cortical plate is described as averaging 2.8mm in dentate and 2.5mm in edentulous jaws, and that was greatest in the second molar region. The authors concluded that a safe thickness for harvesting in the molar region was found at 2.5 to 3mm medial to the external surface of the cortical plate. The drawback in that research was that the marrow space was not easily preserved during the harvest procedure. Thus the distinct parameters of the marrow space, and in-turn, the complete cortico-cancellous component could not be adequately defined.

Computed tomography is a reliable and accurate means to locate the position of the mandibular canal and its relation to the outer cortex. It overcomes disadvantages, such as shrinkage of dry skulls, fracture of subtle structures, magnification, distortion and questionable reproducibility of radiographic images, as has been shown in previous studies.

The height value in the current study is an indication as to the depth of the inferior alveolar canal from the alveolar ridge crest. The results of this study reflect an overall mean height of 13.158mm (±3.282). A study that measured the height of bone above the inferior alveolar canal in the retromolar region using digital panoramic radiographs, found an average height of 11mm in that region. This value from the retromolar region would fall between values taken at points 10mm and 20mm in this study, having heights of 14.85mm and 12.31mm respectively. Levine et al. found an average height of 17.4mm to be present above the inferior alveolar nerve canal in the first molar region, where measurements were taken from 50 CBCT scans. It may be assumed that, in our study, the first molar region is represented by the point at 30mm, having a height value of 12.33mm.

The values reflected in our results show the heights to be greater in males (14.102mm) than in females (12.916mm), the differences being marginally significant (p<0.05). Possibly, this discrepancy may be explained by anatomical differences between male and female jaws. From CBCT studies assessing the location of the inferior alveolar nerve canal in the ramus region for mandibular angle reduction surgery, anatomical differences in the location of the nerve between males and females have been described. Kane AA et al., found the nerve to be significantly deeper from the lateral cortex surface in females than in males. In males the nerve was found to be significantly closer to the anterior border of the ramus and farther from the posterior border than in females. Mandibular ramus sizes were also found to be larger in men than in woman in both width and oblique height in another study by Lo et al. Contrastingly, however, Angel et al., found that the relative location of the canal and its associated mental and mandibular foramina remained fairly constant between the sexes.

Although no significant difference was observed in the widths between dentate and edentulous samples in this region, the mean height value was lower in edentulous mandibles (11.142mm in females and 13.490mm in males) than in dentate mandibles (12.916mm in females and 14.102 in males). This is expected in accordance with the natural resorption pattern and loss of width and height with loss of the dentition. After the dentition is lost, the resorption pattern in the mandible is centrifugal, becoming wider and shorter with time.

This study utilised CBCT images, eliminating disadvantages such as shrinkage of dry skulls, fracture of subtle structures and differences due to magnification. However, certain inaccuracies concerned with mouse settings or operator tracing with the mouse may have been inherent in this study.

This study used points made at ten millimetre intervals from the mandibular foramen. In a study investigating similar dimensions, the teeth have been utilised as anatomical reference points. Perhaps, correlation of the
points made at these intervals with anatomical landmarks would have enabled more substantial comparison between results. This may have also been better suited for anatomical application. Nevertheless, the values could still be applied clinically to assist the clinician, using the mandibular canal reference point. Also, this study aims to investigate the location of the mandibular canal and inferior alveolar nerve with relevance to mandibular ramus autogenous graft harvesting. In order to determine a safe-zone in which to harvest bone, one must also consider teeth that are present within the harvest site. This provides the suggestion that a similar study investigating the height and width of bone available to harvest from the mandibular ramus, including the teeth, would allow quantification of a safe zone. The results obtained in this study may provide useful values that can be used as a guide when harvesting autogenous grafts from the mandible. These values could also be extended to orthognathic surgical procedures as well as during planning for implant placement.

CONCLUSION

This study aimed to measure the average distance from the outer cortex of the mandible to the inferior alveolar canal using CBCT in the mandibular molar region. The inferior canal may be located with a mean width of 5.891mm (±1.09) and mean height of 13.068mm (±2.963) from the external mandibular cortex. Mean height values are lower (±1.09) and mean height of 13.068mm (±2.963) from the external cortical bone. This would be the safest zone when harvesting autogenous block grafts from the mandibular ramus region.

Conflict of Interest: None declared.

References

Comparison of accuracy of digital and conventional radiographies in determining endodontic working length.

**ABSTRACT**

**Introduction:** Determination of the length of the root canal is a critical step in endodontic therapy. Recently, digital radiography has been introduced for this purpose because it may have advantages over conventional radiographic methods. This study aimed to compare the accuracy of digital and conventional radiographic techniques in the determination of the endodontic working length (WL).

**Materials and methods:** Sixty single-rooted premolar human teeth were selected for this study. The teeth were randomly divided into two groups. The WL determination in groups 1 and 2 was carried out using, respectively, digital and conventional radiographic techniques. The procedure was performed by a single operator on two separate occasions, two weeks apart.

**Results:** The differences in WL measured at the two intra-observer intervals was statistically significant neither in digital nor in conventional radiography method (P>0.05). The analysis of the data using a X2 test revealed that there were no significant differences in WL measurements between digital and conventional radiographic methods at any interval (P>0.05).

**Conclusion:** Based on the findings of this study, it may be assumed that the digital and conventional radiographic techniques have similar accuracies in the determination of WL.

**Keywords:** conventional radiography, digital radiography, endodontic working length.

**INTRODUCTION**

A successful root canal treatment depends on finding all root canals and subsequently on a highly efficient removal of both non-pathologic and pathologic bacteria. To achieve this goal, it is necessary to accurately determine the endodontic working length, a measurement also required for the next phase of treatment. Infection in the canal or periapical irritation would otherwise occur due to the improper length of the completed root canal filling. Accurate determination of working length (WL) prevents under-instrumentation and failure to remove infected tissues and microorganisms in the apical region, or over-instrumentation which could cause patient discomfort, damage to periapical tissue, or potentially cause an infection or cyst development from the placement of toxic materials beyond the apex. Traditionally, the technique of choice for determining WL has been using conventional radiography. However, that technique offered some challenges, including superimposition of anatomical structures (mostly the location of the apical foramen in relationship with the apex), and the time required for processing of the film. Due to advancing developments in science and modern technology, digital radiographic systems use a sensor instead of conventional radiographic film on which images are recorded. The advantages of the digital x-ray technique in comparison with the conventional technique include: faster images, the use of a low radiation dose, and a high capacity in demonstrating the details. This study aimed to evaluate and compare the accuracies of digital and conventional radiographies in endodontic WL determination.

**MATERIALS AND METHODS**

Sixty single-rooted premolar human teeth were selected for this study (α = 0.05, power = 80%). Teeth with apical root resorption and with apical foramina situated laterally to the longitudinal axis of the root were excluded. For disinfection, the freshly extracted teeth were stored in sodium hypochlorite (NACLO) 2.5% for 10 min. Firstly, radiographs were taken to confirm patency of the canals and cavity preparation was done on all teeth. The working length was determined for each specimen. A number 15...
K-file (DentsplyMaillefer, Ballaigues, Switzerland) with a silicon stop was inserted into the root canal of premolars (without utilizing any lubrication) until the tip of the file was observable at the apical anatomical apex. The distance from the tip of the file to the silicon stop, adjusted so that it just touched the top of the buccal cusps of the tooth, was measured using an endodontic ruler. Finally, one mm was subtracted from the measured distance. To create laboratory conditions similar to the oral cavity, the teeth were inserted in an acrylic replica, and each tooth was then mounted in acrylic resin. The teeth were randomly divided into two groups of 30 teeth each. Conventional radiographic images were captured in Group 1 by F Speed (AgfaDentus M2) and Philips (Philips,US) systems with exposure settings of 0.08 Sec (60kVp and 7mA) used in the paralleling technique. In the digital group (Group 2), radiographic images were captured with a charge-coupled device sensor (Kodak, NY, Japan) and the images were observed using Kodak software (Kodak, NY, Japan). The procedures were performed by a single operator, repeated after a two-week interval, to increase the accuracy of the study. The investigator observed the images on a viewing box in a procedure room and in each case determined the distance between the radiographic apex and the image of the file tip. The results were analyzed using the chi-square test (X2) and McNemar’s test by SPSS 16.0 (P< 0.05).

Diwanji et al. evaluated the diagnostic efficacy of various methods to determine WL of the root canals and concluded that the use of the apex locator was more reliable and precise than the digital radiography.

In another study, Ehsan correlated the measurements of radiographic and electronic methods of WL determination with the directly observed visual lengths of root canals and evaluated the data. The Root ZX*apex (J.Morita, USA) apex locator was utilized to determine the root canal length. This instrument could calculate the length to within 0.5 mm of the apical constriction at 94.1% accuracy in comparison with the 50.4% accuracy possible when using digital radiographs. Similar findings were obtained by Singh et al. validating the opinion that the electronic method for measuring the WL of root canals was more accurate compared with the conventional radiographic technique. Jeger et al. in a prospective, controlled clinical study concluded that partial cone-beam computed tomography (CBCT) scans can be utilized for endodontic WL measurements. The determination of WL was carried out in several other studies, several completing comparisons. However, the application of the digital radiography technique was preferred as it reduced the duration of endodontic procedures through decreasing the film-processing phase. The computer system provided the zoom function which enhanced the diagnostic process by enlarging regions like the apical zone. A further benefit of digital radiography is the 22% reduction of radiation dose to patients compared with the use of f speed film and the 77% reduction of dose compared with the use of D speed film.

**RESULTS**

The endodontic WL’s determined by measurements on the conventional and digital radiographic images are indicated in Table 1. Correct lengths were determined in 22 teeth (73% of Group One) by the conventional radiography method at the first set of measurements and in 24 teeth (80% of Group One) when the measurements were repeated two weeks later. The Group in which digital radiography had been used showed a slightly increased accuracy with 24 of the Group (80%) recording correct lengths. In both Groups a small number of teeth recorded lengths which were either less than or more than one mm in error. According to the McNemar’s test, there were no significant differences between the original recorded WL measurements and those repeated two weeks later by either technique (P>0.05). Further, the analysis of the Chi squared (X2) test revealed that the differences between conventional and digital radiographic techniques in WL determination were not statistically significant at either time period (χ² = 0.75, P = 0.68, χ² = 1.33, P = 0.51, respectively).

**DISCUSSION**

Accurate WL is a most relevant factor to consider for effective endodontic treatment. Several studies have confirmed the importance of precise WL on the prognosis of endodontic treatments. Apical constriction is the tightest place of the root canal as is obvious on the images that are used for determination of WL. A study by Green demonstrated that the distance between apical constriction and external foramen is 0.5 to 1 mm. In that study, the accuracy of WL determination by digital and conventional radiography were evaluated and compared. The authors found that the differences between two methods were not statistically significant and further that the operator could not affect the result of WL determination.

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Smear layer removal ability and antibacterial activity of endodontic irrigants

ABSTRACT

Introduction: A variety of endodontic irrigants are available for endodontic irrigation. Irrigants must be effective in removing the smear layer created during endodontic therapy as well as eliminating bacteria.

Aim: This in vitro study tested various alternating sequences of sodium hypochlorite, anolyte solution (electrochemically activated water), and EDTA for their ability to do this.

Method: Forty-eight single canal teeth were randomly divided into six groups, prepared to working length, sterilised and inoculated with Enterococcus faecalis. Each group was assigned a different sequence of irrigants. Standard cultivation techniques were used to count the colony-forming units at each phase. Two SEM photomicrographs of each root’s coronal, middle and apical thirds were taken randomly and the number of patent dentinal tubules counted. Statistical analysis was completed using One-way-ANOVA and multiple comparisons.

Results: Group 6 (n=10) protocol of 5ml anolyte followed by 3ml 18% EDTA showed the best smear layer removal results for all thirds of the canal. Chemical irrigation significantly decreased the intracanal E. faecalis CFUs.

Conclusion: Within the limitations of the study anolyte solution followed by EDTA showed the best smear layer removal. The various sequences of NaOCl, anolyte solution, and EDTA all had similar antibacterial results.

Keywords: Antibacterial activity; EDTA; Electrochemically activated water; Irrigants; Smear Layer; Sodium hypochlorite.

INTRODUCTION

Endodontic treatment aims at eliminating microorganisms from the infected root canal system by mechanical and chemical methods.1 Mechanical preparation of the canals leads to the formation of a smear layer. This is an amorphous layer of unpredictable volume, comprising remnants of pulpal tissues, micro-organisms and debris from canal preparation.2,3 The smear layer should be removed as it may act as a substrate for remaining bacteria. Removal improves the seal of the root canal filling materials, reduces microleakage and improves the mechanical retention of the filling material to dentine.4-8

Bacteria remaining in the canals may penetrate the dentinal tubules as deep as 150μm in the apical two thirds of the canal and up to 400μm in the rest of the canal.9-11 Enterococcus faecalis is a bacterium commonly associated with persisting endodontic disease and in secondary infections.12 E. faecalis is able to survive harsh environments due to its high virulence. Within the root canal system it can bind to dentine as it possesses serine protease, gelatinases and collagen binding protein.12

Smear layer removal ability and antibacterial activity of endodontic irrigants.

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METHODS

Ethical clearance was obtained for the use of extracted teeth as well as for the use of E. faecalis (clearance number M050760). Pre-operative radiographs were taken of each tooth specimen. Teeth that had root fractures, multiple canals, complicated canal forms and/or pulp stones or calcifications were excluded from the study. Forty-eight single-canal teeth were selected. They were decoronated at the level of the cemento-enamel junction and the roots cleaned of any deposits using curettes. The canals of each root were explored using a 10 K hand file (Mani, Inc., Utsunomi Ya, Tochigi, Japan). The working length was established by piercing the apex of the canal until the file was just visible at the canal apex, and 0.5 mm was subtracted from this length. A glide file path was prepared using 10 K and 15 K hand files. Thereafter the roots were prepared using ProTaper nickel titanium rotary files (Dentsply, Maillefer, Baillaigues, Switzerland) in an endodontic handpiece according to the manufacturer’s instructions. The canals were prepared using S1 and S2 files, followed by a 20 K hand file, F1 rotary file, 25 K hand file and finally the F2 rotary file. Between each file, and as often as additionally necessary, the canals were rinsed with sterile distilled water. The apices of the roots were sealed with GC Fuji I (GC Corporation, Tokyo, Japan) and the orifices with EcoTemp (Ivoclar Vivadent, New York, USA) (Lot J15944) to isolate the internal environment.

The teeth were randomly divided into six groups and placed in sterile Ringer’s solution for 72 hours. Four groups contained 10 roots each (test) and two groups (controls) contained four roots each. The Ringer’s solutions were replaced at 24 hour intervals. The roots were sonified three times and sterilized at 121°C for 15 minutes in an autoclave. In order to maintain sterile conditions the study was conducted in a positive sterile airflow laboratory, working in a laminar flow cabinet, using sterile gloves, masks and instruments. The 48 roots were placed in sterile bottles containing Casein-peptone Soymeal-peptone Broth (CASO Broth, Merck SA (Pty) Ltd., Halfway House, South Africa) and anaerobically incubated using Anaerocult A® (Merck SA (Pty) Ltd., Halfway House, South Africa) at 37°C for three days. Sterile paper points were inserted into the canals, then placed onto CASO Agar plates and incubated anaerobically using Anaerocult A® at 37°C for 30 days. Negative cultures confirmed that the roots were sterile and did not contain any anaerobic bacteria before the inoculation procedure.

A MacFarland Standard-I suspension (8 x 108 colony-forming units [CFU]) of E. faecalis (ATCC49474) was prepared. A 1% suspension was added to the Broth and incubated anaerobically using Anaerocult A® at 37°C for three days. The Ringer’s solutions were replaced at 24 hour intervals. The roots were sonified three times and sterilized at 121°C for 15 minutes in an autoclave. In order to maintain sterile conditions the study was conducted in a positive sterile airflow laboratory, working in a laminar flow cabinet, using sterile gloves, masks and instruments. The 48 roots were placed in sterile bottles containing Casein-peptone Soymeal-peptone Broth (CASO Broth, Merck SA (Pty) Ltd., Halfway House, South Africa) and anaerobically incubated using Anaerocult A® (Merck SA (Pty) Ltd., Halfway House, South Africa) at 37°C for three days. Sterile paper points were inserted into the canals, then placed onto CASO Agar plates and incubated anaerobically using Anaerocult A® at 37°C for 30 days. Negative cultures confirmed that the roots were sterile and did not contain any anaerobic bacteria before the inoculation procedure.

One hundred micro litres of each suspension was spread onto CASO-Agar plates in triplicate by means of the standardised glass spreading technique to quantify CFUs. The roots were then irrigated for one minute for each irrigant according to the following protocols:

- **Group 1:** (n=4) 3ml sterile distilled water
- **Group 2:** (n=4) 3ml 6% sodium hypochlorite
- **Group 3:** (n=10) 3ml 6% sodium hypochlorite followed by 3ml 18% EDTA
- **Group 4:** (n=10) 3ml 6% sodium hypochlorite followed by 5ml anolyte solution
- **Group 5:** (n=10) 0.5ml 6% sodium hypochlorite followed by 5ml anolyte solution followed by 3ml 18% EDTA
- **Group 6:** (n=10) 5ml anolyte solution followed by 3ml 18% EDTA

Thereafter the irrigants were rinsed out of the canals with 10 ml of sterile distilled water. The irrigants were all delivered using a syringe (Ultradent Inc., South Jordan, USA) and 27 gauge Endo-EZE 1” Irrigator Tip (Ultradent, Inc., USA) to within 2 mm of the canal apex. The same cultivation technique described above was used after irrigation and the CFUs of bacteria that survived the irrigation process were quantified. The percentage difference between the CFUs before and after irrigation was calculated for each group and compared using the t-test (Statistical Package and Service Solutions (SPSS) Inc, Chicago, USA). A p-value ≤ 0.05 indicated a significant statistical difference at a 95% confidence interval. The inter-group percentage differences were compared using One-way ANOVA. Multiple comparisons were made using Tukey HSD or the Tamhane test depending on the normality of the data.

The roots were prepared for Scanning Electron Microscopy according to standard methods. Two photomicrographs were taken per third per tooth. This was done by superimposing a numbered grid over the relevant third and selecting random numbers from a statistical random number table. The selected block was magnified to 2500x. Using Image J software (U.S. National Institutes of Health, Bethesda, Maryland, USA) the open tubules in each photomicrograph were counted independently by two calibrated expert examiners. Partially open and closed tubules were not counted. Open tubules were defined as round, with no smear layer or matter overlying the tubule opening. Bacteria may be present inside the tubule such that a sealer will entomb it when penetrating the canal but may not be covering the opening. Inter-rater reliability was determined using the kappa-test. Where the examiners differed, consensus was reached after discussion. The One-way ANOVA test was used to establish intra-group and inter-group differences. A p-value ≤ 0.05 indicated a significant statistical difference at a 95% confidence interval. The Tukey HSD or Tamhane test was used for multiple comparisons.

RESULTS

Multiple comparisons showed statistically significant differences (p<0.05) between Group 6 and all the other groups, and between Group 5 and Group 1 for the coronal third. There were statistically significant differences (p<0.05) between Group 6 and Groups 1-4 for the middle third (Figure 1).
In the comparison of the apical thirds a statistical anomaly occurred. The one-way ANOVA showed a statistical difference but multiple comparisons failed to show where the differences were. The examiners pointed out that there was a marked visual difference observed between Group 6 and all other groups. Group 6 presented with a thinner smear layer and a larger number of patent dentinal tubules compared with other groups. The latter demonstrated thick smear layers that completely or partially covered the dentinal tubules and inter-tubular dentine.

Intra-group comparisons showed statistically significant differences in the CFUs before and after irrigation for all groups. Inter-group comparisons showed statistically significant results \( (p=0.000) \). Multiple comparisons revealed only a statistically significant difference \( (p<0.05) \) between Group 1 (sterile water) and all other groups.

Figures 2 to 4 show SEM photomicrographs (at 2500x) of the middle third of the canal. Figure 2 is of a Group 3 root after irrigation with 6% sodium hypochlorite followed by 18% EDTA. A regular distribution of open and partially open dentinal tubules can be seen (white arrow). Patches of flat smear layer are seen over a few tubules and on the intertubular dentine (black arrow).

Figure 3 is of a Group 5 root after irrigation with 6% sodium hypochlorite followed by anolyte solution followed by 18% EDTA. A low to moderate number of dentinal tubules are open (white arrow). A thick irregular smear layer can be seen covering most of the intertubular dentine and remaining dentinal tubules (black arrow).

Figure 4 is of a Group 6 root irrigated with anolyte solution followed by 18% EDTA. Regularly distributed open dentinal tubules can be seen (white arrow). A thin smear layer is loosely present over some of the inter-tubular dentine and a few dentinal tubules (black arrow).

**DISCUSSION**

**Statistical Analysis**

Previous studies have analysed the smear layer removal ability of irrigants by semi-quantitative methods. This included assessing each photomicrograph and scoring the smear layer removal on a scale. In this study the actual number of open dentinal tubules was counted in each photomicrograph in order to reduce the possibility of subjective analyses. Due to the variable nature of dentine this quantitative analysis may have allowed for a larger standard deviation than that observed with semi-quantitative analyses.

**Smear layer removal**

Where sodium hypochlorite was the sole irrigant there was a thick irregular smear layer that was structurally different to that observed in the roots irrigated with sterile distilled water. This is in agreement with other research that has shown sodium hypochlorite cannot remove the inorganic portion of the smear layer.

For all other irrigant sequences there was better smear layer removal in the coronal third. This may be because the irrigation solution did not reach the apical and possible middle third due to an operator error, or insufficient canal preparation. Histological differences in dentine may have also affected the smear layer removal in the apical thirds. Smear layer removal may have been improved with increased contact time, more frequent replacement or activation of the irrigants.

Alternating the use of a tissue solvent (sodium hypochlorite) and a chelating agent (EDTA) improved smear layer removal. Alternating sodium hypochlorite with anolyte solution showed a visual trend toward improved smear layer removal compared with sodium hypochlorite alone. This was demonstrated by an increased number of patent dentinal tubules. Sodium hypochlorite produced a thick smear layer, which completely covered the dentinal tubules and inter-tubular dentine. This may indicate the role of the anolyte solution in smear layer removal.

No one group was able to completely remove the smear layer in all thirds, but where anolyte solution was followed by 18% EDTA there was improved smear layer removal compared with other groups. Thus, anolyte solution followed by EDTA may be a promising irrigation protocol. Further research is required to establish the ideal volume, contact time and irrigation method.

**Antibacterial activity**

Where 3 ml of the sodium hypochlorite was used (Groups 2, 3 and 4), the CFU count after irrigation was always zero. Thus 3 ml of 6% sodium hypochlorite with surfactant molecules used for one minute was effective against *E. faecalis* under the conditions of this study.

In Group 5 (sodium hypochlorite followed by anolyte solution followed by EDTA) and Group 6 (anolyte solution followed by EDTA) the CFU count after irrigation was so close to zero that the percentage difference before and after irrigation was deemed statistically insignificant compared with the groups that had a zero CFU count (Groups 2, 3 and 4). Statistically the CFU after irrigation may be deemed insignificant but clinically the remaining microorganisms in Groups 5 and 6 cannot be discounted. Some authors...
have suggested that any remaining bacteria that are not
totombed in the dentinal tubules during obturation may
potentially multiply and migrate apically leading to failure
of the endodontic treatment. E. faecalis is particularly
virulent and may survive for long periods with little or
no substrate. Group 1 (sterile distilled water) had the
highest CFUs after irrigation and the percentage difference
was deemed statistically significant compared with other
groups. This indicates that although chemical irrigation
does significantly reduce the intracanal CFU count, an
antibacterial irrigant is more effective.

The limitations of this in vivo study include a small sample
size and the use of cultivation techniques which may not
be as sensitive to other remaining microbial species.

CONCLUSIONS

Within the limitations of this study, the results indicate the
following:

- For any irrigant group better smear layer removal was
  shown in the coronal third than in the apical third.

- 3ml anolyte solution followed by 3ml 18% EDTA for one
  minute showed the best smear layer removal results
  for all thirds.

- Chemical irrigation significantly decreases the intracanal
  E. faecalis CFUs.

- Sterile distilled water is not effective in decreasing the
  intracanal CFUs.

- All other irrigant protocols were equally antibacterial.

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ABSTRACT
This report explores the role of dental public health specialists in the South African health system in curbing the increasing burden of oral diseases, most of which are preventable. Globally, these specialists play vital roles in addressing the oral health needs and well-being of the whole population through influencing policies and informing decisions. The general neglect of oral health in South Africa coupled with the individually-focused management of oral diseases has led to an exorbitant expenditure of public health funds in the attempt to provide care.

Their expertise equips these specialists competent to design, supervise and evaluate appropriate oral health interventions and preventive programmes to benefit the population as a whole. While there are 33 of these professionals registered with the Health Professions Council of South Africa, their skills seem to be largely under-utilised in the public health system arena with only one being so employed. The increasing prevalence of oral diseases and the lack of success in management of the problem thus far necessitates a critical review of alternative strategies of addressing oral health matters. This paper explores the role of these specialists in addressing the oral health of the South African public at large.

Keywords: oral health, South Africa, dental public health specialists.

INTRODUCTION
The significance of a healthy mouth in general health and well-being cannot be overemphasised. Not only does it allow the individual to eat, speak and chew without difficulty and embarrassment but it is also important for socializing.¹ Diseases of the mouth, on the other hand, may lead to unbearable pain, discomfort, poor nutritional intake and poor growth, often ending in time lost from both school and work. Most oral diseases are preventable and while they are not always life-threatening, they are a major public health problem in South Africa, posing an inordinate economic threat due to the growing demand for public health care.² In spite of the impact oral health has on general health and quality of life, it is still one of the most neglected aspects of health in most developing countries, including South Africa.

STATE OF ORAL HEALTH IN SOUTH AFRICA
Oral health disparities continue to widen, more so in the disadvantaged and vulnerable groups where the vast majority experience the highest burden of oral diseases.³ ⁴ Moreover, there is a general lack of oral health facilities and workforce, exacerbated by an unequal distribution of dental services in the country. To escalate matters further, the high burden of infectious diseases such as HIV and TB faced by the country impacts upon budgetary priorities reducing the availability of funding for oral health matters.⁶ While 84-90% of the South African population is dependent on the public oral health services, only just one quarter of all South African dentists were employed by the public sector in 2009.⁷

The results of the last National Oral Health Survey (1999-2002) revealed that approximately 45-60% of children living in South Africa require treatment for dental decay.⁸ In the Western Cape Province alone, 80% of children needed dental care. It was further indicated that 32% of children require orthodontic treatment because of premature dental extractions. The considerable majority of adolescents and adults presented with gingivitis and periodontal diseases.⁹ With the high prevalence of HIV/AIDS, many of the infected patients also suffer oral HIV-associated lesions.

MEETING THE ORAL HEALTH NEEDS OF THE POPULATION
To effectively address these issues, there is a need for an alternative oral health care system, which is population-based with a focus on prevention of oral disease and oral health promotion, as opposed to the existing curative-
The last National Oral Health Survey in South Africa was conducted over a decade ago. There are currently no oral health surveillance data being collected on a continuous basis besides that of services provided. There are very few existing school-based oral health programmes in the country and regrettably, there is no monitoring and evaluation of these efforts resulting in very little knowledge regarding the effectiveness of these programmes. These factors raise critical questions with regards to the reliability of what is now known about the state of oral health in the country and hence what resource allocation is appropriate. Evidence shows that dental public health specialists are the driving force and the key experts in efforts to improve the oral health of the population. The current strategies in place such as the National Health Insurance (NHI) and the School Health Policy provide a good platform on which these professionals may most effectively be used. The South African Government and the Department of Health need to make informed decisions leading to utilizing these professionals in Provincial Health Departments to facilitate delivery of the much needed oral health services. This would not only ensure that the training invested in these specialists and their future colleagues does not go in vain but, more importantly, is definitively for the good of the public in ensuring the delivery of optimal oral health care.

**CONCLUSION**

The manner in which oral health issues have been addressed in the South Africa has not been effective to date. Curative treatment of oral diseases is economically draining for the country, with estimates that the total costs for providing curative dental care would outstrip the whole healthcare budget in low-income countries. Curative treatment is technically challenging and requires the use of expensive equipment and highly skilled professionals. Some developed countries have taken strides in investing in preventive oral health programmes, largely with the expertise of dental public health specialists. They have not only reported significant savings in dental health expenditure but also reductions in the prevalence of oral diseases.

In contrast to South Africa, where the role of these specialists is mainly limited to academic institutions, several other countries have demonstrated an effective use of community dentists in other areas of health. In some countries, these specialists work collaboratively with communities, governments and other health agencies to develop resources, to plan and implement oral diseases prevention programmes and the promotion of good oral health. They also work with food and drug administration where they can influence policies in regulations regarding constraint of certain harmful trades in order to protect and promote good public oral health. Under the aegis of Medical Research Councils and National Health Institutes, population based studies are conducted to answer critical dental public health questions and the specialists are also involved in translating their findings into recommendations. As lecturers in schools of public health, medical schools and nursing schools, they incorporate dental education in different curriculums. They work as oral health advocates, advising, amongst other responsibilities, how to balance budgetary resource allocations to meet the identified needs. It may be seen that their essential role is the assessment of dental care needs and the monitoring of disease trends, of the utilization of dental services and of the required manpower of the dental workforce, enabling an evaluation of the delivery of dental services.

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**Conflict of Interest:** None declared.

**References**


SUMMARY
Periodontal disease (PD), along with cardiovascular and circulatory disease, diabetes mellitus, chronic respiratory disease and obesity, are globally regarded as some of the major non-communicable diseases (NCDs). The association between PD and these systemic illnesses is described as bidirectional. Gaining an understanding of the strength of the proposed associations between these diseases is important, as it will enable health professionals to identify common risk factors that will allow for synergistic prevention, diagnosis and management. To date, common preventive measures for NCDs include cessation of smoking, increased physical activity, healthy diets and sensible consumption of alcohol. Although risk factors such as smoking, inactivity, unhealthy diets and alcohol abuse are among the leading cause of tooth loss due to lifelong exposure, the prevalence of tooth loss is increasing in middle-income countries like South Africa. Hence the strength of the associations between PD and selected NCDs will be assessed, in order to generate guidelines for dental and other health professionals as well their patients to address the burden of disease associated with PD. Lastly, possible solutions to the problem will be addressed.

Keywords: periodontal disease, cardiovascular disease, diabetes mellitus, obesity, chronic obstructive pulmonary disease

INTRODUCTION
Periodontal disease (PD) has been recognised as a major global public health problem due to its prevalence, economic impact on the health care system and health consequences. Hence it is cited as one of the top six chronic non-communicable diseases (NCDs). Prospective cohort studies provide evidence that PD is associated with an increased risk of premature death from any cause. This resulted in the formulation of a hypothesis that PD may be a risk factor for other diseases. A global estimate regarding the prevalence of the 50 most common consequences of disease such as diabetes mellitus found that chronic PD accounted for 10.8% of the population with NCDs, including chronic obstructive pulmonary disease (COPD), uncomplicated diabetes, as well as cardiovascular (CVD) and circulatory diseases. The association between oral, and especially metabolic systemic illnesses, is described as bidirectional. Disability-adjusted life years (DALYs), a measure of disease burden, provide evidence that the global burden of disease has continued to shift from communicable to NCDs. The prevalence of ischaemic heart disease became the leading cause of DALYs in 2010 when compared with 1990 (increase of 29%), followed by lower respiratory tract infections (44% decline). With regards to PD, the global DALYs for all ages showed a 57% increase for the same period.

Identification of NCDs which are associated with PD and understanding the strength of the proposed associations are important, as it will enable health professionals to identify common risk factors in order to strive towards attaining synergistic control of these diseases. Etiological and pathological links between PD and NCDs have also been suggested. This has resulted in global support towards the control of PD through approaches that address common risk factors.
Evidence generated from data related to 291 diseases amassed from 21 global regions, supports the association between PD and NCDs for cardiovascular disease (OR 1.1-2.4), type 2 diabetes mellitus (OR 1.5-2.3) and chronic respiratory tract diseases (OR 1.1-2.0). In addition, an association between obesity and PD has been suggested with both diseases being classified as NCDs.8 To shed light on the strength of these associations, the 9th European Workshop in Periodontology resulted in the publication of a European Federation of Periodontology (EFP) Manifesto, calling upon dental and health professionals to act on the prevention, early diagnosis, and effective management of PD.2

The World Health Organisation (WHO) state that the top ten causes of mortality in South Africa, include diabetes mellitus (34.9%), HIV/AIDS (33.2%), lower respiratory tract infections (25.6%), hypertensive heart disease (16.6%), stroke (6.5%) and ischaemic heart disease (4.8%).10 However, the NCD epidemic can be prevented through reduction of the underlying risk factors, early detection and timeous treatment.11 In sub-Saharan Africa, infectious disease mortality rates are expected to decrease by 40% over the next 20 years, while NCD associated mortality rates will increase by 12%.12 The latter underscores the fact that the prevalence of communicable diseases are decreasing while that of NCDs are increasing at a more rapid rate in low- and middle-income countries such as South Africa than in developed ones.13 In addition, more than 80% of mortality and 40% of all disabilities are linked to heart disease, cancer, respiratory disease and diabetes.12

An extensive global focus on NCDs in 2011 lead to the United Nations (UN) High-Level Meeting on NCDs with the predominant emphasis being on heart disease, stroke, cancer, diabetes and chronic respiratory diseases.14 The UN declared that NCDs are not only of concern for health, but also for development, as it acts as a barrier to development goals.15,16 A South African national summit adopted a declaration that included a set of ten targets to be reached by 2020. NCDs that were addressed included cardiovascular disease, diabetes, chronic respiratory disease, and oral diseases as they are largely preventable through attention to four major risk factors that include smoking, physical inactivity, unhealthy diets and alcohol abuse.17 The above was echoed by the WHO, indicating that this is ultimately the leading cause of tooth loss as result of tooth decay and PD, caused by lifelong exposure to these risk factors.15

According to the global World Health Survey, the prevalence of complete tooth loss is increasing dramatically in middle-income countries, especially among the poor and disadvantaged, with striking intra-country inequalities of complete tooth loss.18 As South Africa is classified as a middle-income, transitional country where changes in dietary and activity patterns are occurring rapidly due to urbanisation and the resultant influences on nutrition, the findings of the global World Health Survey are of particular concern. The nutrition transition has resulted in an increase in the prevalence of overweight and obesity, not only a risk factor for developing NCDs,16 but an NCD in its own right.17,19 Urbanisation, industrialisation, economic transition and health services that are not always adequately equipped to deal with NCDs, are cited as being responsible for the increase in local morbidity and mortality rates.11

Cardiovascular disease
The proposed mechanisms linking PD to the development of CVD, are related to systemic inflammation, promotion of atherogenesis or provoking cardiovascular events,20,21 such as angina, myocardial infarction, stroke and peripheral arterial disease.21 Chronic PD results in the entry of bacteria or their by-products into the circulatory system. The host immune response reacts by favouring the formation, maturation and exacerbation of atheroma.22,23 Another feasible hypothesis is that active aggressive PD is an important source of the endotoxemia that contributes to the onset of septic shock syndrome.24 Whether the association between PD and CVD is independent and clinically significant, remains controversial.25

As a result, an investigation into the association between PD and CVD is of great importance, given the high incidence of both diseases and their related economic cost to society and the potential impact on public health should risk modification or therapeutic opportunities be identified. A statement issued by the American Heart Association indicated that common risk factors shared between the two conditions include smoking, increasing age and diabetes.20,21 In addition, observational studies support an association between PD and atherosclerotic vascular disease, independent of known confounders.25,26 However, a causal relationship is not supported. Despite a reduction in systemic inflammation due to periodontal treatment, marked by a reduction in CRP levels and an improvement in clinical measures of endothelial function in short term studies,21 there is a paucity of evidence that a reduction in systemic inflammation prevents atherosclerotic vascular disease or modifies the outcomes.20,21 Systematic reviews were conducted to investigate the effect of periodontal treatment on the prevention, and management or recurrence of cardiovascular disease in patients with chronic PD.2,27 Only one appropriate study was found, yielding low quality evidence and hence rendering it insufficient to support or refute whether periodontal treatment can prevent the recurrence of cardiovascular disease in the long run amongst patients with chronic PD. In addition, no evidence regarding primary prevention was found.27 Several animal models have demonstrated that the host’s inflammatory response related to bacteria entering the blood stream favours atheroma formation, maturation and exacerbation.28-30

Consistent epidemiological evidence in turn, found that PD increases the risk for future cardiovascular disease, independent of other confounding factors.31 While many studies have alluded to a positive association between PD and atherosclerotic vascular disease, others have yielded conflicting results, especially after adjusting for potential confounders.32

Guidance for patients with cardiovascular disease
Clinicians should be aware of emerging evidence regarding the relationship between PD and atherosclerotic CVD, independent of other risk factors.34 Patients should be advised that PD places their general, as well as oral, health at risk. Based on current evidence, patients with PD and other risk factors for developing atherosclerotic CVD such as hypertension, overweight/obesity and smoking who have not undergone a medical examination in the past year, should be referred to a physician.2 Controlling lifestyle-associated risk factors, including smoking cessation, nutrition counselling, and recommendations for
regular exercise, should be addressed within the context of comprehensive oral/periodontal treatment plans.\textsuperscript{34, 35}

**Diabetes mellitus**

Prospective epidemiological studies confirm that PD increases the risk of poor glycaemic control, diabetic complications and associated morbidity.\textsuperscript{2, 35, 36} In addition, susceptibility to PD in diabetics is increased threefold and there is a clear relationship between the degree of hyperglycaemia and severity of PD. The mechanisms that underpin the association between the two diseases are not completely understood. What is known, is that it involves aspects of immune functioning, neutrophil activity and cytokine biology.\textsuperscript{37} Chronic hyperglycaemia and the accumulation of advanced glycation end products are due to an increased secretion of pro-inflammatory cytokines.\textsuperscript{38} Some theories propose that advanced glycation end-products, changes in collagen formation, and altered immune function may facilitate the presence of bacteria in tissue. Effective treatment of PD is associated with a reduction in Glycosylated haemoglobin (HbA\textsubscript{1c}) of approximately 0.4% at three months. This equates to adding a second drug to the pharmacological management of diabetes.\textsuperscript{2, 37} Type 2 diabetes is preceded by systemic inflammation, leading to reduced pancreatic B-cell function, apoptosis and insulin resistance. Increasing evidence supports elevated systemic inflammation (acute-phase and oxidative stress biomarkers), resulting from the entry of periodontal organisms into the circulation, thus providing biologically plausible mechanisms which are responsible for the undesirable impact of PD on diabetes and its complications.\textsuperscript{2} Consistent and robust epidemiological evidence demonstrates that severe PD adversely affects glycaemic control in diabetics and glycaemia in non-diabetics. In addition, there is a direct and dose response related effect between the severity of PD and diabetic complications. Emerging evidence also indicates an increased risk for diabetes onset in patients with severe PD.\textsuperscript{2, 37} Although the majority of research has focused on type 2 diabetes as a risk factor for PD, type 1 diabetes also increases the risk of PD. Accordingly, all patients with diabetes (including children and young adults), should be considered at an increased risk of PD.\textsuperscript{37}

**Guidance for patients with diabetes mellitus**

Diabetic patients should be informed that the risk of PD is increased by poor glycaemic control. Furthermore, attaining glycaemic control may be more difficult in the presence of PD and in turn, can increase the risk for diabetic complications.\textsuperscript{2, 38} All newly diagnosed diabetics and patients with gestational diabetes, should receive an initial evaluation that includes a comprehensive periodontal examination with regular follow-up examinations as part of the ongoing management of the disease. For diabetic adolescents and children, annual oral screening is recommended from the age of six to seven years.\textsuperscript{2}

**Chronic obstructive pulmonary disease**

There is emerging evidence for an association between PD and COPD such as chronic bronchitis and emphysema.\textsuperscript{41} It appears to be a dose related effect, whereby more severe PD is associated with increasing loss of lung function.\textsuperscript{27} The primary etiological factor is smoking,\textsuperscript{4, 41} modified by underlying inflammation,\textsuperscript{42} likely caused by bacterial or viral infections or both.\textsuperscript{43} In addition, PD and COPD share similar risk factors that include increasing age, obesity and a poor socioeconomic status.\textsuperscript{45, 46} It is considered plausible that the inflammatory response may be altered, either through aspiration or dental plaque and/ or haematogenous diffusion or inflammatory mediators and plaque organisms from periodontal pockets.\textsuperscript{44} Due to the relationship between the anatomical position of the oral cavity and the pulmonary tract, oral bacteria can easily be transported to the lungs, causing infection.\textsuperscript{45} The only evidence of causality is related to respiratory microorganisms that colonize the periodontal biofilm that may subsequently cause nosocomial pneumonia in mechanically ventilated patients. Epidemiological evidence supports a role of the periodontal biofilm acting as a reservoir for respiratory pathogens in patients with poor oral hygiene and PD and the resultant nosocomial pneumonia. Randomised controlled trials and a cross- sectional comparative study strongly support an improvement in oral hygiene as part of the prevention of nosocomial pneumonias and respiratory disease in acute care hospital environments and nursing homes.\textsuperscript{46, 47} Due to conflicting evidence generated by epidemiological studies investigating the relationship between PD and COPD, a meta-analysis was conducted to investigate this relationship. Findings based on random-effects meta-analysis were the existence of a significant association between PD and COPD (OR 2.08; p<0.001) with sensitivity analysis showing that the results were robust. The authors concluded that PD is a significant, independent risk factor for COPD. However, the causality of the relationship remains unclear.\textsuperscript{46}

Studies investigating the relationship between PD and COPD remain preliminary, and large-scale prospective epidemiological studies are needed. Adequately powered randomised clinical trials that test the efficacy of periodontal interventions on the progression of COPD are required to further investigate the role of PD on its pathogenesis.\textsuperscript{48} The association between dental plaque and pneumonia appears to be stronger than for dental plaque and COPD.\textsuperscript{46, 48}

**Guidance for dental and other health professionals managing patients with respiratory disease**

Improved oral hygiene reduces the risk of health care associated pneumonia as is suggested by several meta-analyses.\textsuperscript{46, 48} Based on data from five randomised controlled trials, it is recommended that staff responsible for caring for the elderly and/or frail, should be trained regarding the provision of basic oral hygiene for those who are incapable of self-care, and the implementation of twice daily oral hygiene in those capable of self-care. Hospital staff working in acute care environments should be trained on the use of antimicrobial and manual methods of reducing the oral microbial load in mechanically ventilated patients.\textsuperscript{45, 47}

**Obesity**

There is growing evidence regarding an association between PD and obesity.\textsuperscript{49, 50, 51} An increase in the prevalence of obesity has resulted in an increased burden of NCDs such as diabetes, with recent evidence suggesting a possible link to PD.\textsuperscript{35, 36} Obesity is both an indirect risk factor for developing diabetes due to its effect on glycaemic control and a direct risk factor due to secretion of pro-inflammatory agents by adipose tissue that modify the periodontal reaction to the plaque biofilm.\textsuperscript{46} Adipose cells secrete more than 50 bioactive molecules collectively known as adipokines that play a role in the regulation of inflammation, immunity and
insulin resistance. The immunologic activity of adipose cells is one of the main reasons why obesity is referred to as a chronic disease. Given evidence that adipose tissue serves as a reservoir for inflammatory cytokines, it is possible that an increase in body fat increases the likelihood of an active host inflammatory response in PD. A modest, and poor housing. Additional risk factors include an unhealth lifestyle, high dietary sugar content, inadequate oral hygiene due to poor dexterity, smoking and excessive consumption of alcohol. The current global patterns of oral disease reflect distinct risk profiles across countries, related to living conditions, behavioural and environmental factors, oral health systems, and implementation of schemes to prevent oral disease. Oral health care coverage is low in middle-income countries and most low- and middle-income countries where the general population does not benefit from systematic oral health care. Barriers to oral health care among older individuals include impaired mobility which hampers access to oral health care, particularly for those who reside in rural areas associated with a lack of public transport. This situation is worsened when oral health services and domiciliary care are not available. As some older individuals may experience financial difficulties following retirement, the cost or perceived cost of dental treatment, together with a poor attitude towards oral health, may deter them from visiting a dentist. In addition, the fear of violence may make them apprehensive of strangers, hindering good communication with oral health service providers.

### Guidance for dental and other health professionals managing overweight/obese patients

It has been postulated that the prevalence of dentists may promise stronger primary health care resources and may highlight an opportunity for greater engagement of dentists in nutrition education and the prevention of obesity. Hence, the association between the number of dentists per capita and adult obesity rates were investigated. Findings were that having one additional dentist per 10,000 population was significantly associated with a one percent reduction in the prevalence of obesity (p < 0.001) and was significantly larger in counties in which 25% of children or more, lived in poverty and in counties who had more primary care physicians per 10,000 population (p ≤0.0009). The correlation between the prevalence of dentists and obesity highlights the potential for dental professionals as well as primary care providers to provide meaningful health education and support for improved nutritional behaviours. Additional prospective studies are needed to quantify and understand the mechanisms regarding the association between overweight/obesity and PD. A lack of evidence currently hampers the provision of guidelines to clinicians regarding the management of PD in overweight/obese adults.

### Factors affecting oral health

Globally the burden of oral disease is especially high among older individuals and is strongly affected by social factors such as a low level of education, poverty, and poor housing. Additional risk factors include an unhealthy lifestyle, high dietary sugar content, inadequate oral hygiene due to poor dexterity, smoking and excessive consumption of alcohol. The current global patterns of oral disease reflects distinct risk profiles across countries, related to living conditions, behavioural and environmental factors, oral health systems, and implementation of schemes to prevent oral disease. Oral health care coverage is low in middle-income countries and most low- and middle-income countries where the general population does not benefit from systematic oral health care. Barriers to oral health care among older individuals include impaired mobility which hampers access to oral health care, particularly for those who reside in rural areas associated with a lack of public transport. This situation is worsened when oral health services and domiciliary care are not available. As some older individuals may experience financial difficulties following retirement, the cost or perceived cost of dental treatment, together with a poor attitude towards oral health, may deter them from visiting a dentist. In addition, the fear of violence may make them apprehensive of strangers, hindering good communication with oral health service providers.

### Potential solutions

Public health solutions to oral disease are most effective when they are integrated with those for other chronic diseases and with national public health programmes. The WHO Global Oral Health Programme aligns its work with the strategy of chronic disease prevention and health promotion. The WHO Manifesto calls for a fundamental change in the perception of dental professionals’ responsibilities regarding the achievement of patient general health and affirms that the patients’ needs are best met through a collaborative approach between dental and medical professionals to provide coordinated multidisciplinary patient care, irrespective of where an individual enters the health care system. Furthermore, there is growing appreciation that the dental team could play a key role in both the screening for NCDs and the promotion of healthy lifestyles, in particular amongst individuals who seek dental care but rarely consult a medical practitioner.

Most chronic dental problems are highly dependent on daily self-care practice and compliance with preventive such as teeth brushing with fluoride toothpaste. Meta-analyses and systematic reviews of oral health interventions point towards the absence or ineffectiveness of educational interventions for the prevention of oral disease. In fact, conventional health education focusing on disseminating information and giving normative advice is insufficient to achieve sustained behavioural change. Hence, transforming knowledge into actions which are beneficial and affordable to the population as well as creating opportunities and conditions that enable individuals and communities to enjoy good oral health is a great challenge.

### CONCLUDING REMARKS

The association between the PD and CVD remains controversial as, to date, a causal relationship is not supported. PD increases the risk of poor glycaemic control, diabetic complications and associated morbidity. In addition, susceptibility to PD in diabetics is increased and there is a clear relationship between the degree of hyperglycaemia and severity of PD. An association between PD and COPD such as chronic bronchitis and emphysema is supported by emerging evidence. Evidence regarding causality is related to respiratory microorganisms that colonize the periodontal biofilm, subsequently being responsible for nosocomial pneumonia in mechanically ventilated patients. The association between dental plaque and pneumonia appears to be stronger than for dental plaque and COPD. Obesity is both a direct and indirect risk factor for developing diabetes, thus suggesting that obesity might...
adversely affect PD. However, there is a lack of evidence that PD may affect obesity. Additional prospective studies with the necessary statistical power are needed to quantify and understand the strength of the relationship between PD, CVD, diabetes, COPD and overweight/obesity in order to guide the prevention and management of these NCDs.

**Conflict of Interest:** None declared.

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Double *Dens In Dente*: A rare anomaly

**ABSTRACT**

*Dens in dente* refers to a developmental anomaly associated with an abnormal infolding of the inner enamel epithelium into the dental papilla. This in turn gives rise to a possible communication between the pulp and the oral environment, increasing the susceptibility of the tooth to caries, pulpitis, and pulpal necrosis, which highlights the need to detect and seal these pits early. This case report documents an unusual case of double *dens invaginatus* affecting maxillary central incisors.

**Keywords:** Dental caries, *dens invaginatus*, developmental anomaly, surgical operating microscope

**INTRODUCTION**

*Dens in dente*, dilated composite odontome, gestant anomaly, and dens telescope are terms commonly used to refer to *dens invaginatus* and are considered to reflect variations in its presentation. 1 It is observed in 0.25% – 5% of individuals 2 and is most commonly associated with maxillary lateral incisors (1.7% – 38.5%). It is more frequent in the maxilla than the mandible3 and is seen most often in Caucasians and Asians. Although mostly asymptomatic, *dens in dente* has been reported to be associated with various syndromes such as Ekman–Westborg–Julin syndrome, Williams syndrome, and Nance Huran syndrome.4,5

The aetiology of *dens in dente* remains unclear; however, various studies have reported genetics and a variable growth rate as possible causative factors. Mechanical factors, such as growth pressure leading to buckling of the tooth germ and trauma, infection, and a twin theory suggesting the fusion of two tooth germs, are also suggested as causative factors.6-8

Based on the location and extent of invagination, the anomaly can be divided into coronal and radicular types. The depth may vary from being only a lingual pit to a situation giving the appearance of a tooth within a tooth. These factors affect prognosis and treatment. This article reports a case of double *dens invaginatus* in maxillary central incisors and the management of the anomaly.

**CASE HISTORY**

An 18-year-old boy reported to the dental outpatient department with the chief complaint of discoloration of the front teeth and sensitivity on water consumption. No history of pain, swelling, or pus discharge was reported. The patient reported no history of systemic diseases. On examination, the patient exhibited palatal caries in maxillary incisors (tooth numbers: 11, 21, 12, and 22), with extensive carious lesions associated with the right maxillary incisor. All teeth gave a positive response to vitality testing. No pain was elicited on palpation or percussion. Oral hygiene was good. Other active carious lesions were not noted. An intraoral periapical radiograph (Figure 1) revealed the presence of a single type I *dens invaginatus* in the left maxillary central incisor (21) and a double *dens invaginatus* in the right maxillary central incisor (11). The tooth anatomy otherwise appeared normal (Figure 2). Caries excavation was performed using a number two steel round bur, followed by the placement of a calcium hydroxide liner (Dycal, Dentsply, Tulsa, USA) and temporisation with zinc polycarboxylate cement (Poly F, Dentsply, UK). The patient was recalled after eight weeks. At the second visit, the symptoms had subsided and a positive...
response was elicited to vitality testing. The temporary restoration was removed, and the tooth was observed under a surgical operating microscope (OPMI-Pico, Carl Zeiss, Germany) at 8X magnification to rule out the presence of remnants of the temporary restoration (Figure 3).

The tooth was etched using 35% phosphoric acid for 20 seconds, rinsed and dried. A dentin bonding agent (Curex, DPI, Mumbai) was applied and light cured for 20 seconds. Flowable composite resin (Tetric N flow, Ivoclar Vivadent) and a capping layer of micro-hybrid composite (Esthet X HD, Dentsply, Tulsa, USA) were used to restore the tooth.

**DISCUSSION**

Various classifications have been proposed for dens invaginatus. However, the most commonly accepted classification was proposed by Oehler (based on the extent of coronal invagination).

- **Type I:** An enamel lined minor form occurs within the crown of the tooth and does not extend beyond the cemento- enamel junction.
- **Type II:** An enamel lined form which invades the root as a blind sac. It may or may not communicate with the dental pulp.
- **Type III:** A severe form that extends from the root and opens into the periodontium. It is further divided into two sub-types:
  - a: An invagination that runs into the root, and communicates laterally with the periodontal ligament, without pulpal involvement.
  - b: An invagination into the root that communicates with the periodontal ligament at the apical foramen, which is usually lined usually by enamel and rarely by cementum.

Most authors report the presence of a single dens within the tooth. However, double or triple dens in dente have been noted, but rarely. A recent review claimed that only nine case reports of ‘double dens invaginatus’ have been published. This anomaly refers to the condition in which two enamel-lined invaginations are present within the tooth. It is most commonly seen in relation to the maxillary anterior and supernumerary teeth and may on occasion lead to pulpal involvement.

The clinical importance of this condition cannot be over-emphasised because it may contribute to pulpal disease. Researchers have noted that enamel in the region of the dens may be hypomineralised, which allows the easier spread of microbes. In addition, because of the tortuous lingual anatomy of the anterior teeth, subsurface caries may develop within the dens invaginatus, without a break-down of the external tooth surface. This facilitates the progression of caries, which may lead not only to external cavitations but may also enter the main pulp chamber through intercommunications between the dens and pulp cavity. The rarity of Type III (5%) anomaly compared with that of Types I (79%) and II (15%) anomalies highlights the need for a careful radiological and clinical assessment of each case.

Treating the pulpal involvement of teeth with the dens invaginatus may require special endodontic techniques because of the complexity of the anatomy. Therefore, a careful examination of teeth with an enlarged palatal cingulum, conical morphology, and increased labiolingual size is advocated because these signs reveal increased chances of a dilated composite odontome. Methylene blue dye can be used to distinguish the foramen caecum (clinically dilated opening of the dens) from normal fissures.

With the advent of microdentistry, the surgical operating microscope is an invaluable tool for visualising the anatomy and extent of the dens. It allows for a more conservative preparation, thereby reducing the chances of pulpal exposure. In cases of Type I dens in dente (such as the present case), prophylactic sealing of the potentially problematic region is recommended.

**CONCLUSION**

**Dens in dente,** a developmental anomaly, could lead to dental caries which may communicate with the pulp cavity, resulting in pulp necrosis. Its management requires a prompt detection of the anomaly and prophylactic intervention. With delayed detection and subsequent pulpal involvement, more advanced endodontic interventions may be required because of the complexity of the pulp anatomy.

**Conflict of Interest:** None declared.

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ABSTRACT

Osteomyelitis of the maxilla rarely occurs.1 Treating this condition presents a challenge to the Oral and Maxillofacial surgeon as a result of the diverse clinical and radiographic presentations which influence the choice of the treatment modalities. This case report highlights the importance of early surgical exploration in patients with chronic suppurative osteomyelitis of the maxillary and zygomatic bones that has remained refractory to prolonged antibiotic treatment.

Key words: chronic, suppurative, maxilla, exploration, osteomyelitis

INTRODUCTION

Osteomyelitis may be defined as an acute or chronic inflammatory process in the medullary spaces or cortical surfaces of bone.2 It begins as an infection of the medullary cavity, involving the Haversian systems and subsequently extends to involve the overlying periosteum of the affected bone. Bone destruction with sequestration is a characteristic feature of the disease.3 Osteomyelitis can occur due to infections from bacterial, viral or fungal micro-organisms, which may arise from a root canal, periodontal ligament, fracture site, soft tissue wound or surgical site, such as an extraction socket.4 Serious complications may ensue, such as cerebral abscesses, encephalitis and meningitis.2,4,5

Hudson classified osteomyelitis into acute and chronic forms, based on the disease having a clinical duration of more than one month.6 Peterson classified acute osteomyelitis into three types, one with a contiguous focus, another of the progressive type and one of the haematogenous type. He classified chronic osteomyelitis as being recurrent multifocal Garré’s, suppurative or non-suppurative and sclerosing.2

Treatment of this condition with appropriate antibiotics early in its course may result in complete resolution of the infection.7 However, allowing the infection to progress without adequate treatment over a prolonged period may result in the need for repeated surgical debridement and antibiotic treatment. Suppurative osteomyelitis can involve the periosteum, cortex...

ACRONYMS

BIPP: bismuth iodoform paraffin paste  
CT: computed tomography  
FCOD: florid cemento-osseous dysplasia

Figure 1: Pre-operative view of cutaneous fistulae.
or bone marrow. In an established case, the symptoms may include deep bone pain, induration, swelling with erythema of the overlying soft tissue, malaise, fever, adenopathy, paresthesia in the distribution of the sensory nerves, trismus, anorexia and discharging sinuses.\(^2,8\) Within 10-14 days after the onset of osteomyelitis, teeth in the involved area may become mobile and sensitive to percussion. Pus may exude around the gingival sulcus or through mucosal and cutaneous fistulae.\(^8\)

Maxillary osteomyelitis occurs infrequently compared with mandibular osteomyelitis.\(^1\) This may be due to the rich vascularity and thinner cortices of the maxilla, which promote rapid healing. There are also more possibilities for collateral blood supply than exist in the mandible. These characteristics of the maxilla allow adequate drainage of oedematous fluid and pus into the soft tissues and paranasal sinuses, reducing the chances of festering infection within the bone. However, when an infection does not respond to regular treatment methods, it is essential that the problem is recognised early and is treated aggressively by the surgeon to avoid life threatening complications.\(^5\)

The treatment objectives in these circumstances are to remove dead bone and eliminate or diminish the presence of the causative micro-organisms by using a combination of surgery, antibiotics and supportive care.\(^9\) Surgical options may include either open surgical exploration or endoscopic exploration and then debridement.\(^10\)

This paper discusses a rare case of chronic suppurative osteomyelitis of the right zygomatic bone which presented with persistent discharging sinuses in the regions of the right cheek and lateral border of the right orbit.

**CASE REPORT**

A 55 year old female with a medical history of hypertension and type II diabetes was referred to the Maxillofacial and Oral Surgery Clinic, Grey’s Hospital, South Africa. The patient presented with a right unilateral facial swelling with pus discharging through three cutaneous fistulae in the right zygomatico-orbital region, the lesion being of three years duration (Figure 1). The patient had undergone a maxillary sequestrectomy performed three years ago by the Department of Otolaryngology. This was done in an attempt to treat her chronic suppurative sinusitis, which had eroded her maxillary sinus walls and hard palate (Figures 2 & 3). She had received several doses of antibiotics including a Penicillin derivative such as Amoxicillin combined with Clavulanate, an Imidazole such as Fluconazole, a Tetracycline such as Doxycycline and a Nitroimidazole such as Metronidazole on separate occasions spanning the three year period.

The records of the patient did not reveal whether investigations for microbial culture and sensitivity were done. It was therefore presumed that antibiotics were administered empirically. The discharging sinuses had not resolved with the antibiotic treatment. Several computed tomography (CT) views, recorded at the time of attendance at the MFOS Clinic, confirmed the presence of a circumscribed mixed radiopaque/radiolucent lesion, 1.4 cms in diameter, within the body of the zygomatic bone extending from the region of the right lateral antral wall to the infero-lateral orbital margin. The lesion contained a hypodense cortex with multiple air loculi within and around it, an appearance in keeping with the features of a sequestrum (Figure 4). A provisional diagnosis of chronic suppurative osteomyelitis was made.

A culture swab of the inflammatory exudate demonstrated colonies of Actinomyces. The treatment plan involved surgical and medical management. The patient was surgically explored under general anesthesia. An incision was made along the pre-existent scars in the right infraorbital region along the fistula and in the region of the zygomatic buttress. This approach was used with a view to accomplishing a simultaneous scar revision. The sequestrum as well as the associated granulation tissue were removed. The cavity was burred down until healthy bone was found (Figure 5). The revised scar was approximated using resorbable sutures subcutaneously, and non-resorbable sutures were inserted on the skin. Gauze soaked in bismuth iodoform paraffin paste (BIPP) was placed into the defect intraorally and then removed after five days. The patient was discharged under antibiotic cover, which included Amoxicillin and Metronidazole, for a period of two weeks. Subsequent clinical reviews of
the patient revealed complete resolution of the infection (Figure 6). Histology of the excised tissue confirmed the presence of a sequestrum associated with necrotic bone surrounded by inflamed granulation tissue.

DISCUSSION
Chronic osteomyelitis of the maxilla or zygomatic bone may result in the formation of a single or multiple extra-oral sinuses, bone loss and facial disfigurement. Patients with co-morbidities such as diabetes, immunosuppressive therapy and radiotherapy are particularly susceptible to developing osteomyelitis, which may be refractory to medical management. Various other systemic diseases have also been associated with osteomyelitis including malignancies, malnutrition and acquired immune deficiency syndrome. Medications that may trigger osteomyelitis include steroids, chemotherapeutic agents and bisphosphonates. Paget’s disease of bone and florid cemento-osseous dysplasia (FCOD) result in a decrease in vascularity of the affected bone, which predisposes to the development of osteomyelitis.

In this case, diabetes may have contributed to the progression of the infection. Acquired immune deficiency syndrome was excluded as a contributing factor. Treatment after isolating Actinomyces by microbial culture should be vigorous. In view of the prolonged duration of the infection, a decision was taken to perform surgical exploration and debridement of the affected areas followed by postoperative administration of antibiotics. It has been shown that lysis of Actinomyces species occurs at a rate slower than that seen in other microbia and therefore, prolonged antibiotic administration is recommended.

CONCLUSION
This case of chronic suppurative osteomyelitis of the maxilla emphasises the need for early exploration of an infection site which has draining sinuses associated with the maxillary and zygomatic bone. In lesions that fail to respond to antibiotic therapy, early surgical exploration and debridement is recommended, and should be accompanied by vigorous antibiotic administration, determined after culture and sensitivity investigations. Early resolution of such lesions is desirable to improve the quality of life of patients and to prevent possible life-threatening consequences.

Conflicts of Interest: None declared.

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B Buch,1 M Machaka,2 M Mabongo3

ABSTRACT
Two cases of sialoliths. a.) A 32 year-old female, referred to the Wits Oral Health Centre by a private periodontist who suspected a stone in the submandibular duct. The patient experienced a sharp stabbing pain beneath the right side of her chin, exacerbated on eating. Intraoral palpation of the duct revealed nothing. Panoramic and scanning radiography confirmed a small radiopaque sialolith near the angle of the mandible, measuring 6.43mm in diameter. Sialography determined it was wedged within the genu of the duct. Surgical access was difficult, possibly leading to removal of the entire gland. As the pain had subsided, the patient will be monitored over the following few months. b.) A fifty two year-old male patient with a three year history of pain and swelling on the right side of his face. Previous medical consultations failed to diagnose the cause. Intraorally a creamy-white, bony-hard lesion was visible, perforating through the sublingual mucosa. Various radiographs confirmed the presence of a giant sialolith, measured on cone-beam scan at 25 x 26mm. Excisional biopsy easily shelled out the stone. The resultant cavity was marsupialized and the defect sutured. Possible causes of Sialolithiasis, the various imaging modalities and alternative treatment options are discussed.

CASE REPORTS
Case 1
A thirty two year-old female patient presented at the Wits Oral Health Centre complaining of a sharp stabbing pain beneath the right side of her chin. Her pain was much exacerbated during meals and had been of about two months’ duration. She had previously consulted a private periodontist who, on the basis of her symptoms, had diagnosed a possible submandibular sialolith. He had referred her to the Wits Oral Health Centre for confirmation and possible treatment.

A slight swelling was visible beneath the right side of the patient’s chin although nothing distinctive was palpable intraorally along the superficial course of the submandibular duct.

A panoramic radiograph revealed a small radiopacity surrounded by a radiolucent periphery near the angle of the mandible beneath the inferior alveolar canal (Figure 1). The radiographic appearance together with the patient’s symptoms confirmed the presence of a sialolith.

A cone-beam scan was undertaken in order to establish the size of the stone and its relative position with respect to the medial border of the mandible (Figure 2 A and B). The stone was found to measure 6.43mm in greatest diameter.

A sialogram was performed in order to determine the exact location of the stone within the submandibular duct. This
revealed that the sialolith was wedged within the genu of the duct, causing a blockage, thereby preventing filling of the parenchyma of the gland by the contrast medium (Figure 3).

The small size of the stone together with its awkward position in the duct would make surgical removal difficult without damaging the duct. This might necessitate the removal of the entire gland.

Since the patient’s pain had by then somewhat subsided, it was decided to monitor the patient over the following few months in order to determine whether the duct might adapt over the course of time or otherwise the stone may possibly move to a more accessible position, enabling easier surgical access.

**Case 2**

A fifty two year-old male patient presented at the Wits Oral Health Centre complaining of a painful swelling on the right side of his face (Figure 4). His symptoms were of three years’ duration. He had previously consulted a medical practitioner who informed him that his skin had reacted to shaving. The patient was treated with numerous courses of analgesics and antibiotics to no avail. The patient then sought treatment at the Wits Oral Health Centre.

On intra-oral examination a creamy-white, bony hard lesion was visible lingual to the 47/48 region which was beginning to perforate through the sublingual mucosa (Figure 5). A preliminary diagnosis of a salivary sialolith was made.

Panoramic, lateral oblique and cone-beam radiographs were taken, all of which revealed a large radiopaque lesion apical to the 48. This confirmed the presence of a sialolith (Figures 6, 7, 8, 9).

The lesion on cone-beam was seen to measure 25 x 26 mm in diameter (Figure 10). This, according to modern literature, would be considered a giant sialolith.

An excisional biopsy was performed under local anaesthetic and a creamy-white chalk-like substance was easily shelled out. Marsupialization of the resultant cavity was carried out and the defect sutured with 3/0 chromium catgut.

The patient recovered well and uneventfully from the procedure and was followed up for two months. At the final visit the saliva was seen to be draining well through the residual opening at the surgical site.

**DISCUSSION**

Before the advent of modern imaging modalities which today are somewhat taken for granted, radiological diagnosis of salivary gland pathoses was carried out by means of sialography.

Sialography is the process of demonstrating the duct system of salivary glands radiographically by injection of radiopaque media, the medium of choice being iodized oil. Calculi, the most common cause of duct obstruction, may be seen on plain x-ray films (termed scout films in sialography) provided that the calculus is radiopaque. Despite this fact, however, the use of a sialogram would pinpoint its exact position in the duct, aiding surgical
Sialolithiasis is one of the most common diseases of salivary glands accounting for about 50% of salivary gland pathoses. It refers to the formation of calcifications within the ducts or parenchyma of the gland. The majority of stones (80-90%) are found in the submandibular gland. The reasons for this as often quoted are that the submandibular duct is very tortuous with a marked genu together with the increased viscosity of its secretions. There appears to be an indication that patients with salivary stones may be prone to develop nephrolithiasis.

The exact cause of calculus formation is not fully known but a number of factors have been cited as contributory. These include altered calcium metabolism, altered pH, dehydration, poor eating, and the use of certain drugs such as antihistamines, anti-hypertensives, psychiatric and bladder control drugs. Tobacco chewing has also been cited as a factor. There also appears to be an association between salivary calculi and certain other conditions like gout, nephrolithiasis and liver disease. In the UK it was postulated that residents of hard water areas were at risk of developing Sialolithiasis. However, a study by Sherman et al. based on statistics for the years 1991 to 1994 showed that water hardness was not significantly associated with the development of salivary calculi.

Since not all stones are radiopaque, plain x-rays are not always able to detect such stones which may be in the duct or in the parenchyma of the gland. Ultrasound appears to be well-established in cases where Sialolithiasis is clinically suspected but not evident on plain x-rays. MRI scans have been utilized for visualising stones as well as for mapping the ductal anatomy of the gland. CT may also be used for this purpose but is not as effective as MRI. These modalities, however, are somewhat costly and are not routinely used.

Sialoliths measuring 25mm or more are termed giant sialoliths. Krishnan et al. have reported on two cases and maintain that giant sialoliths have rarely been reported in the literature. However, a very superficial search of the literature has revealed a further five cases, and our second reported case would also fall into this category. The occurrence of giant sialoliths may therefore not be as rare as was stated.

The treatment of choice for most salivary stones, particularly very large ones, has for decades been surgery. However, non-surgical options are now being used to treat symptomatic stones. These include extracorporeal shock wave sialolithotripsy, balloon dilatation, endoscopic removal and laser therapy.

**Conflict of Interest:** None declared.

**References**


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**Conflict of Interest:** None declared.
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* With twice-daily brushing. † Parkinson C et al., 2013 reported a 33% reduction from baseline in Schiff sensitivity score at Week 8 for a stannous fluoride toothpaste.

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reduction in dentin hypersensitivity from baseline after 8 weeks*¹³
reduction in plaque build-up after 24 weeks compared to regular fluoride toothpaste*¹⁰
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What is the aim of conservative dentistry: A clinical dilemma

What is the aim of conservative dentistry? Is it not to provide long-term dental health?

At first glance this mouth presents with a perfectly healthy set of teeth. The aesthetics are good. The soft tissue looks healthy and sound. It would appear to be a picture of health. It is probable that to the patient his mouth teeth feel fine. He probably has no awareness of any restorative problems.

But lift the veil of the anterior teeth and gain access to the posterior teeth. Surprisingly there is a breakdown on the distal aspect of the lower left first molar!

Let’s presume that the bitewing radiograph show no caries on the mesial aspect of the second molar tooth nor on the mesial aspect of the first molar tooth itself. The only breakdown is the lingual aspect of the distal marginal ridge and a small buccal pit.

This tooth needs restoring. What is the restorative material of choice to provide the patient with a long-lasting definitive restoration? Should it be an amalgam, a composite, a ceramic inlay or a cast gold inlay. Does the tooth need a crown? And what about the buccal caries?

In a discussion in a recent study club meeting many in the group expressed the opinion that the tooth be best restored with a composite restoration. Is that what you would have in your mouth?

Would the composite restoration restore the tooth to its original anatomy providing a good contact and marginal ridge?

Although the extent of the caries appears to be limited, the chances are that the tooth destruction is extensive.

Would you not consider a cast gold inlay or ceramic inlay to provide the clinical excellence needed to restore this tooth for long-term health?

Editor’s Comment:
What is your opinion? Let us have a response.
Lasers in Paediatric Dentistry

INTRODUCTION
Many clinicians will be faced with the un-cooperative paediatric patient presenting at their practices with a “fear of the unknown”. Establishing trust with these patients is essential in order to achieve a productive interaction with the child. The hard tissue lasers (Er:YAG and Er,Cr:YSGG) have the advantage of not producing the high pitched sound and vibrations associated with turbines. The “tell-show-do” method can be used to illustrate the water spray with the lowest possible energy setting of the laser in the paediatric patient’s mouth, which may assist in alleviating fear associated with the restorative procedures.

A SYNOPSIS OF LASERS IN PAEDIATRIC DENTISTRY
The hard tissue lasers target the water molecules present in the enamel and dentine producing expansive vapourisation. The effect of the hard tissue laser on the tooth and bone constitutes true ablation ie. surgical removal. The rate of ablation of tooth structure during cavity preparation with the laser is comparable to that of the turbine in clinical practice. The hard tissue laser has the advantage of less thermal and mechanical damage to the surrounding tooth structure, compared with the turbine.3,4

The absorption coefficient of the Er,Cr:YSGG (4000cm-1) is lower than that of the Er:YAG (13000cm-1) for enamel,4 however both lasers will allow acceptable clinical parameters for tooth preparation.5 The water content of carious dentine is higher (27% - 54%) than that of healthy dentine (20%-24%).6 Dentinal tubules in primary teeth are anatomically larger in diameter than those found in secondary teeth. Therefore carious dentine in primary teeth will have a faster rate of ablation, which must be taken into consideration when the laser energy parameters are selected for the procedure.

Using the concept of minimally invasive restorative procedures, the erbium and 9300-nm CO2 lasers allow the operator to remove only diseased tissue, thereby preserving the healthy, unaffected tooth structure. The effect of the CO2 for tooth ablation is limited due to the low interaction with the hydroxyapatite. Erbium lasers also avoid the small microfractures in enamel which are produced with the use of conventional dental handpieces.7

CONCLUSION
The AAPD recognised the use of lasers in paediatric dentistry as a complementary method for soft- and hard tissue procedures in infants, children and patients with special health care needs. The AAPD stated that it is essential that the clinician receive: “didactic, experiential education and training on the use of lasers before applying this technology on paediatric dental patients”.8

References

ACRONYMS
Er:YAG: Erbium-doped Yttrium Aluminum Garnet
Er,Cr:YSGG: Erbium-Chromium-doped Yttrium Scandium Gallium Garnet
AAPD: American Academy of Paediatric Dentistry
INTRODUCTION
Traditionally, medicine has been governed by the principle of *Primum non nocere* - “first do no harm”, which implies both doing good and avoiding doing harm. However, in medical research, this approach is far too simplistic. Today we need also to be attuned to the vast domain of related ethical issues. In ethics, as indeed in English, many terms and concepts are clearly confusing. They may seem similar, yet be different: is petrol flammable, or inflammable? Others question logic, dishonest and honest, so why not diseased and eased (instead of healthy)? Many terms are also highly debatable; if someone sets out to fail and actually succeeds, is that a success or a failure? This paper will explore some basic principles of medical ethics and then relate them to scientific research in terms of study design. These principles give guidance for the protection and safeguarding of researchers, participants (specifically dental patients), and the community.

PRINCIPLES OF MEDICAL ETHICS
Beauchamps and Childress1 considered medical ethics in terms of patient treatment under four headings:

- **Autonomy** or “self-rule”, in which patients are empowered to make their own decisions regarding their treatment. However, before they can do this, the clinician is obliged to provide to them assurances of confidentiality, education, understandable communication, truthful details, before finally gaining their voluntary consent.

- **Beneficence** implies that all interventions should aim to improve health by following accepted standards, with an expectation of success. The intention behind treating must be to always do good, and be in the best interest of the patient.

- **Non-maleficence** is more than just the avoidance of inflicting any physical, psychological, emotional or other form of pain, suffering or harm. It also refers to taking positive steps to prevent harm or to removing potentially harmful influences.

- **Justice** refers to fairness and fair treatment. This involves legally respecting morally acceptable laws, fair distribution of limited resources, fair selection of study participants, fair distribution of risks and benefits, and respect for personal rights.

In medical research, these underlying principles apply, and one would assume that by following them, the study would be ethical. However, in reality it is not quite as simple. There are many “non-obvious” scientific areas that have associated ethical aspects. Thus a researcher oblivious to the nuances could inadvertently conduct unethical research, and unintentionally mislead others.

ETHICS OF RESEARCH
It is no longer morally acceptable to justify treatment decisions in the practice of Dentistry with statements such as “in my hands” or “this is what I have always done, so why change?” Today, all clinical practice must be based on “The Best Available Evidence”. This has led to an explosion of research into all aspects of Dentistry. However, not all research is sound, and not all results are valid. Investigations are futile unless they are scientifically valid, ethically responsible, the results are subjected to critical appraisal and peer review, and the findings made known publicly. Thus evidence based dentistry (EBD) strives to keep clinicians up to date by providing them with educated recommendations that can guide their clinical decision making.

Ethics of study design
Research is defined as “Systematic investigation, development, testing and evaluation, designed to contribute to generalizable knowledge”.

A valid research project should fulfil two key criteria: it must involve a systematic investigation; and the design and purpose of the investigation should aim to develop or contribute to generalizable knowledge. In addition, all research should be conducted in a scholarly manner with the researcher taking responsibility for the design, methodology and execution of the study. It should be planned in such a way that the findings will be valid, reliable and repeatable. All results (both positive and negative), as well as limitations should be documented and subject to peer
review, and then made publically available. In both the execution of the project and the communication of the findings the researcher must adhere to the principles of honesty, clarity, comprehensiveness, accountability, and be open to public scrutiny. These principles also apply to the relationships with the research community, research participants, general society and research sponsors. In addition researchers should not misuse their positions for personal gains.

What constitutes unethical study design?

- Poor planning. A design that has not been well thought out and structured is destined to encounter complications. These could delay or even halt the entire study. This results in wasted time (for the researcher and anyone else involved), wasted resources which could have been put to a better use, inconvenience, and depriving society of potential new knowledge.

- Research for the sake of research. Unless there is a specific problem or uncertainty that needs to be answered, it is a futile waste to embark on a meaningless study. For this reason the first steps in any study should be to identify a question and then to conduct a thorough literature search to make sure that the answers are not already known.

- Having a pre-meditated assumption or wish as to what results will be obtained. This can tend to bias the manner in which the entire study is performed and will certainly prejudice analysis and interpretation of the results.

- Poor science. Inexperience, lack of background knowledge and expertise, unstructured design, non-adherence to recommended protocols, not following manufacturer's instructions, and faulty techniques, all constitute poor science. By association this equates to unethical research as the results will be unreliable, invalid and unrepeatable. A worse scenario is that others may accept the results as true and use the study as a basis for their actions. If patients are involved the outcome could be dire.

- Not having statistical knowledge, and then failing to consult a statistician. It is imperative that the type of study design is clearly described before planning the methods. A statistician will be able to advise on which tests could be used to answer the research question, and will then be able to calculate the minimal sample number needed for this application. Guidance may also be provided on sampling methods, randomization, blinding, coding to allow for anonymity, and prevention of selection bias.

- Failure to consult and take advice from experts in areas beyond the expertise of the researcher. Once again, this is unethical as it may jeopardize the quality of the study and potentially limit the strength of the findings. It should be borne in mind, however, that in any collaborative study, it is imperative to agree upfront on the partnership roles, amount of input and benefits in terms of authorship and publications.

- Non-adherence to manufacturer’s instructions for material use. As mentioned above, this could lead to unreliable and invalid results, which may not be repeatable by others. If published, others may use this erroneous information to the detriment of their practice and their patient’s health.

- Non-adherence to the documented protocol. Changing methods mid-way (unless a patient’s life is at risk, or any serious adverse events have been noted), could alter the entire study, and lessen the validity and reliability of the results. If changes are needed, the reasons for, and the time and nature of, the deviation, should be documented and declared in the final write up.

- Any form of dishonesty or research fraud. Altering data, omitting negative results, plagiarism, even unintentional misrepresentation due to sloppy work and inaccurate results all constitute fraud as they deceive others into believing false information.

- Plagiarism. Copying other people’s ideas, duplicating studies or quoting literature without acknowledging the original pioneer constitutes plagiarism and is considered research fraud.

- Accepting remuneration from companies to conduct research. Sponsorship of materials is common in clinical trials. However, accepting remuneration in exchange for conducting studies for private companies can jeopardize the integrity of the research. This is particularly so in situations where the sponsors interfere, or retain the results. There is the risk that negative findings may then be concealed. To safeguard the researcher, the nature and amount of sponsorship and remuneration must be declared, and a statement issued to the effect that there is no conflict of interest. Details of all donations and remuneration for both the researcher and the study participants should be outlined in a written contract. This should also state that “all findings will be made responsibly and freely available to the public within a specified, limited timeframe.”

- Failing to complete a research study. Poor planning, insufficient funds, lack of time, poor judgement, inexperience, lack of required skills, loss of interest, or any other preventable obstacle that leads to the study being aborted is unethical. This results in wasted time, reduced resources, inconvenience, and denies the broader community of new knowledge.

What constitutes unethical participant recruitment, selection and management?

Clinical trials need to be conducted in accordance with the ethical principles laid out in the Declaration of Helsinki. Accordingly, the rights, safety and well-being of participants must always be the primary concern, and should prevail over the interest of science or society. Any research involving study participants, especially if they are also patients, carries a risk of their being vulnerable or exploited. This may be due to power differentials, economical disadvantages, pain or medical debilitation, and language or educational barriers. It is particularly relevant in developing countries where patients may rely on the presence of a research project to make goods, services and treatment available to them. The Council for International Organizations and Medical Sciences (CIOMS) has set guidelines on the ethics of clinical trials in order to protect vulnerable populations.

They state that informed or valid consent must address three questions: 1) does the patient have the capacity to consent (age, maturity, cognitive ability); 2) is the consent voluntary and 3) has the patient received sufficient information on which to base their decision? It is important to note that consent is a process and not an event. Patients need time to think before agreeing, and must be able to withdraw at a later stage for any reason without question or repercussions.

- Unfair or unequal selection of sample and control participants. This could skew the results and also advantage/disadvantage certain people at the expense of others. It occurs when there is selection bias or a lack of random selection and blinding.
• Preferential benefits by virtue of being in the study group. In any situations where an intervention, treatment or therapy is being tested, the control group must be given the gold standard if it exists. A placebo is only ever warranted where there is no accepted standard of care, and the participant is fully aware that they may or may not be in the experimental group. In addition, if the results of the study are positive, the control should also be offered the treatment, device, or new discovery for free.

• Research carried out on a population group who will not benefit after conclusion of the study. “Those that bear the burden of research ought to receive the benefits”. Subjects selected should not have a history of acquiescence, neither should they be excluded from the benefits of the research if it is proven successful. This includes provision of therapy for those who were allocated to the control group. In addition, there should be some foreseeable advantage for the community to which the study participant belongs. Socially responsible investigators should make provision for benefits to be allocated to the broader society, albeit for a limited period of time.

• Non-therapeutic research. Ideally the research and interventions should also be therapeutic in nature, or if non-therapeutic, should pose minimal risk. However, in the case of non-therapeutic surveys, the observers are morally bound to provide referrals, follow up treatment and feedback to study participants (if they have indicated that they would like this, in which case anonymity becomes an ethical issue).

• Not maintaining confidence. Almost all studies involving human participants are anonymous and results are confidential. The only time this may be overturned is when findings could put a third person or the wider community at risk.

• Provision of a device (specifically dental implants) for research purposes, without making provision for the follow up treatment (superstructure) or maintenance. Manufacturers have been responsible for a universal explosion of research into new implant systems. Many uninformed patients benefit from “free” implant placement, but are not warned of the additional costs that they will have to incur in placing restorations and in subsequent maintenance. This has led to an unacceptably large pool of patients with buried or non-functional implants, who have not reaped any benefits for the burden of their participation. There should always be a written agreement as to the extent of the investigator’s involvement and responsibilities both during and after the trial, as well as a time limit for these.

• Coercion, giving false promises or creating unrealistic expectations. This includes offering remuneration or other incentives, in order to recruit study participants. It invokes people’s vulnerabilities (economic, physical, educational, social) and may entice them into taking increased risks that the “average man” would not take under normal circumstances.

• Promising treatment (or denial of same) in exchange for participation in the study. As above this is a form of coercion that preys on the vulnerabilities of participants.

• Not communicating with study participants. The researcher must ensure participants are educated and informed about all aspects of the study. This includes giving all the relevant information both verbally and in a written form, in the appropriate language and style, taking into account cultural differences and sensitivities. Consent is a process, not an event, and recruits should be given time to think and consult with others before giving free and voluntary consent. They should also be made aware that there will be no penalties or withholding of treatment should they decline to participate, and that they are free to withdraw at any time during the course of the investigation. Note, this does not refer to situations where data has been gathered or questionnaires have already been answered and submitted. These cannot be later retracted.

• Lack of equipoise. This concept is best explained as a consideration of the balance between the risks of the experiment and the beneficial outcomes. Studies with minimal risk to the subject and high benefit to the scientific/patient community pose no problems. However, those with increased risks to the participant and small benefits for society are considered unethical, and should not be undertaken.

• Not being culturally aware or sensitive. Certain interventions may not be culturally acceptable in a wider community. Exposing study participants to such activities may render them subject to repercussions when they return to their communities.

CONCLUSIONS

Researchers and specifically clinician-investigators, should always be cognisant of the relationship and power differentials that exist between themselves and their patients and/or study participants. Patients seek help to address issues that concern them, while study participants help the researcher address issues that concern him/her. Many times the two may overlap where the provision of treatment is also the subject of the investigation. In general, any research involving human subjects should be submitted to a relevant ethical review board for approval. Their approval helps safeguard researchers, as well as provides protection of the study participants. A final ethical question to consider is when is treatment routine, and when does it become “experimentation”? This will form the basis of Part 5 in this series. In conclusion, any person carrying out scientific research has an ethical and moral obligation to conduct themselves professionally, and to place the interest of patients, the scientific community and the general public above personal goals and desires.

References
Maxillo-facial radiology case 145

Below are clinical and radiographic images of patients who presented in the Department with the main complaint that they were not happy with the aesthetic appearance of some of their teeth which developed as they grew older. What is your diagnosis?

INTERPRETATION

The images above present the classic features of congenital syphilis. Syphilis is caused by the infection with spirochete Treponema pallidum. The acquired form is usually further subclassified into three distinctive stages: primary, secondary and tertiary. The bone may be affected in congenital syphilis and in both the secondary and tertiary stages of acquired syphilis. The jaws are rarely affected in syphilis. When they are, the palate is more frequently involved than is the mandible. The purpose of this communication is to discuss the effects of congenital syphilis on teeth. Figures A&B are examples of Hutchinson's teeth. Hutchinson's triad was first described by Jonathan Hutchinson, an English surgeon, in 1858 as being pathognomonic of congenital syphilis. The triad consisted of (1) diffuse interstitial keratitis (deep deposits in substance of the cornea, which becomes hazy throughout), (2) disease of the labyrinth (canals of the inner ear) and (3) Hutchinsonian teeth affecting the permanent maxillary incisors. The typical "Hutchinsonian incisor" is smaller than the normal incisor and the crown may converge from the cervix to the incisal edge. As a result, the tooth is narrower at the cutting edge than at the normal-sized gingival margin. This gives the tooth a barrel or screwdriver form. In addition the incisal edge is usually notched (Figs A & B, yellow arrows). After Hutchinson's description, it was later recognized that changes might also occur in other permanent canines, and first molars. The "mulberry" molar (Fig.C) was first described by Fournier in 1884. Sometimes these molars are called Fournier molars or Moon's molars. Fig D is a case of congenital syphilis affecting the palate and demonstrating mulberry molars on the 18 and 28 (red arrows). According to Putkonen (1962), the so-called mulberry molar is smaller than the normal first molar tooth. The mulberry molar is covered on the sides with normal enamel but the occlusal surface is pinched together, dwarfed, rough, and hypoplastic, often pigmented (green arrows).

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1. Using social media to improve compliance and duration of treatment in orthodontic patients: A RCT


Depending on the individual case, orthodontic treatment usually takes a long time to obtain the desired result. Studies have also found that behaviour-related factors such as missed appointments, unplanned debonding of brackets, and poor oral hygiene, could significantly prolong the duration of orthodontic treatment. These might imply poorer compliance of the patients. Therefore, reducing these factors has become an important element when managing these patients in an orthodontic practice.

Communication via cellphones has become an important tool in the health care arena. The use of short message services (SMS) and other applications such as WhatsApp, We Chat, BBM, etc have revolutionised the manner in which we can communicate with patients. In Dentistry, evidence has shown that attendance could be notably improved by simply sending a reminder of any type before the appointments. Similarly, education and reminder messages were found to effectively enhance patients’ oral hygiene and knowledge.

In the past few years, WeChat (Tencent Ltd., Shenzhen, China. ‘Weixin’ in Chinese version) has become one of the most popular messaging software on cell phones, especially among Chinese young people. There are more than 1.12 billion registered users and 600 million active users of WeChat worldwide, mostly in China. It is not only a software for chatting like WhatsApp and Facebook Messenger but also one of the most trendy platforms for news reading, blogging, and social networking. WeChat has a multifunctional background interface, allowing service providers to deliver texts and multimedia contents to all subscribers. There is a paucity of studies that have explored the use of these platforms in the dental field to communicate with patients and even fewer studies have been attempted to determine whether such technologies can shorten the treatment time by promoting compliance among orthodontic patients.

Li and colleagues (2016) from China reported on a randomized clinical trial that sought to investigate whether mobile intervention using WeChat, vs. usual care, would improve the attendance and oral hygiene of patients, reduce the incidence of bracket debonding, and consequently, shorten the duration of orthodontic treatment (DOT).

**MATERIALS AND METHODS**

This was a non-blinded, two-arm randomized controlled trial in China conducted among adolescents or adults admitted for orthodontic treatment. Participants were randomized 1:1 to the intervention group or control group after the initial examination. Eligibility of a patient was determined after the treatment plan was finalized. Patients were excluded if they (1) were unable to read Chinese; (2) did not use smartphone that could install WeChat app; (3) preferred the lingual or invisible bracketless technique; (4) were planned for a multiphase treatment, like combined orthodontic-orthognathic treatment; (5) presented a case too complicated to be finished within three years; and (6) disclosed a possibility that they may migrate to another city within the predicted treatment period.

Thus, only those orthodontic patients with fixed appliance and single-phase treatment participated in the trial. Demographics and dental profile concerning the orthodontic treatment were recorded.

At a patient’s first visit, a standard examination procedure was performed to make a proper diagnosis, including study casts, panoramic and lateral cephalometric radiographs, extra-oral and intra-oral photograph, etc.
Two combinations of bracket systems were used in the treatment: Damon Q self-ligating brackets with Damon Q archwires and HX straight wire brackets (non-self-ligating), plus IMD OrthoShape archwires (IMD). All brackets were bonded with light-cured composite and patients were asked to revisit every four weeks. If any brackets accidentally debonded, patients could visit the clinic for the removal of the loose items, but had to wait until the next appointment to have the brackets rebonded. A fee was charged for this repair. If a patient failed to attend or cancelled an appointment, they were rescheduled to two to four weeks later. The end of the treatment was defined as when the treatment goal had been achieved, and all brackets and other appliances were removed.

Participants in WeChat group were instructed to subscribe to the research account of the investigators on WeChat at the first day of treatment. For patients under 18 years, at least one of their parents was also added as a message receiver. The researchers’ phones were also added to the receiver lists. There were basically two types of messages: reminder messages with brief texts and educational messages with rich texts and pictures. Reminder message of attendance was scheduled to be sent twice (one week and one day) prior to the appointment. Patients were asked to reply to the appointment reminders if possible. Other reminders were focused on behaviour change. Educational messages were linked to articles on oral health tips and knowledge. Patients enrolled in the same week were grouped into the same batch, which received the same scheduled educational messages. All contents were written in Chinese. Participants were allowed to browse more contents by clicking the hyperlinks. They could also query the next appointment, or open the Frequently Asked Questions option and source the answers.

The conventional-care-only control group received the same orthodontic strategy and pre-treatment education as in the WeChat group but they were not afforded the opportunity to use the WeChat platform.

The primary outcome measure was the duration of orthodontic treatment (DOT). DOT was defined as the period (weeks) from the initial application of brackets to the completion of treatment. The subsequent period using a retainer was not counted in the duration of orthodontic treatment. The time taken to complete treatment was also calculated. The secondary outcomes included (1) failed attendance, (2) late attendance, and (3) bracket bond failure. The exact time of attendance was recorded. It was counted as a failed attendance if the patient came too late and required rescheduling. It was not counted as a failed attendance if patients requested rescheduling one week or earlier prior to their appointment. The tertiary outcome measure was the oral hygiene condition, graded with orthodontic plaque index (OPI) and modified gingival index (MGI). The OPI and MGI were evaluated at the first visit after the initial bonding (baseline) and just before treatment completion (endpoint).

RESULTS

Two hundred and twenty four patients (n=224) were included in this trial; and 112 were randomly allocated to each group. All 224 patients completed their treatment and were included in the analysis. There were more females in the study (156, 69.6%). The mean age of participants was 17.6 ± 5.7 years, and nearly half were adults (105, 46.9%). Extractions were performed in nearly half of the cases (103, 46.0%). Self-ligating brackets were applied in 139 (62.1%) subjects. All the demographics and baseline characteristics were balanced between the two groups.

The duration of orthodontic treatment (DOT) in WeChat group was significantly shorter, compared with the control group (median 80.5 vs. 84.5 weeks, range 66–93 vs. 75–103, P = 0.007). The mean difference between the two groups was 7.3 weeks (95% CI 3.7 to 11.6). The Kaplan-Meier curve showed that individuals in WeChat group were likely to complete treatment earlier than control (HR = 1.49, 95% CI 1.14 to 1.95; p = 0.003).

There were 2161 and 2380 appointments altogether in WeChat and control group. The total number of failed and late attendance in WeChat groups was 68 (3.1%) and 435 (20.1%) respectively compared to 256 (10.9%) and 706 (29.9%) in the control group. Patients in the WeChat group had significantly fewer failed attendance than the control group (65, 31.3% vs. 83, 74.1%; RR = 0.42, 95% CI 0.31 to 0.57).

In terms of bracket bond failure, there were 666 (16.3% of 4104 bonded) brackets bond failures during the treatment period. A lower rate of bond failure was observed in WeChat group versus the control group (11.8 vs. 16.1%, P < 0.001). The number of individuals who had at least one bracket debonded showed no significant difference between the two groups (56.2 vs. 68.8%, P = 0.053). However, subgroup analysis found fewer adults with bond failure after WeChat intervention (24.5 vs. 48.1%, P = 0.024).

There were no significant differences between the two groups as regards the orthodontic plaque index (OPI) and modified gingival index (MGI) at either baseline or endpoint evaluation.

Five compliance-related factors concerning attendance, bracket bond failure, and oral hygiene were screened using a univariate approach. Failed attendance was identified as the only independent factor affecting the time to finish treatment. This implied that the greater the number of missed appointments, the more likely it was that the treatment completion was delayed (P = 0.004, HR = 0.89, 95% CI 0.84 to 0.95). No adverse effect of the intervention was reported throughout the research.

CONCLUSION

This trial showed that the intervention using a mobile messaging app effectively reduced the duration of orthodontic treatment. It also improved the attendance of the patients and decreased the bracket bond failure rate when compared with patients who did not use the mobile app.

IMPLICATIONS FOR PRACTICE

This trial has showed improvements in treatment management among patients who were linked to a mobile message system. This study has highlighted the potential for the expanded use of social media in health in our setting where cellphones are used by the majority of the population.

Reference

2. Assessment of postoperative pain after reciprocating or rotary NiTi instrumentation of root canals: a randomized, controlled clinical trial


Endodontic postoperative discomfort is defined as any degree of pain that occurs after endodontic treatment.1 This phenomenon is known in literature as flare-up, which is characterized by the development of pain, swelling or both, beginning within a few hours or days after the surgical procedures.1

The recent introduction of rotary and reciprocating endodontic systems has resulted in reduced treatment times, less patient discomfort and less pain during the procedure when compared with the traditional mechanical way of cleaning and obturating root canals.1 Recent studies have shown that the treatment protocols of new reciprocating systems can also produce extrusion of debris in the apical region, which could be related to postoperative pain when compared with other traditional instrumentation techniques.1

Thus, on the premise that an innovative reciprocating system can cause different levels of pain after endodontic treatment, Relvas and colleagues (2016)1 reported on a study that sought to assess postoperative pain in a prospective randomized clinical trial comparing two groups, using the Reciproc® system in one group and the ProTaper® rotary system in the other. The primary outcome measure of the study was to assess whether different instrumentation techniques influence the occurrence of postoperative pain.

MATERIALS AND METHODS

This was a randomized, controlled, double-blinded parallel-group trial with an equal allocation rate between groups. The study sample consisted of men over the age of 18, who had had previous indication for endodontic treatment in permanent mandibular molar teeth and had been diagnosed with asymptomatic pulp necrosis. The pulpal status was confirmed by a negative response to cold and electric pulp tests and was confirmed later by a negative response to the cold test was performed by spraying a cotton swab, which was then placed on the occlusal surface of the tooth. If there was no response after five seconds, the test result was considered negative.

A glide path was established using PathFiles #0.13, 0.16, and 0.19 for both groups (Dentsply Maillier). The working length was confirmed with an electronic apex locator and radiography. Instrumentation of the root canals was performed in accordance with the manufacturer’s recommendations and began with the canal negotiation using size 10 K-file and the PathFile instruments #0.13, 0.16, and 0.19. For the Reciproc® system, the instruments were driven by the VDW Silver® motor, specifically programmed for reciprocating instrumentation.

The instrumentation of the root canals with the ProTaper® system began with the canal negotiation with the size 10 K-file and the PathFile instruments #0.13, 0.16, and 0.19. Canal shaping was achieved with ProTaper rotary instruments following the manufacturer’s instructions. The instruments were also driven by the VDW Silver® motor.

Table 1: Demographic and clinical characteristics of study recruits

<table>
<thead>
<tr>
<th>Baseline of demographic and clinical characteristics</th>
<th>Reciproc (n = 39)</th>
<th>ProTaper (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>25.8 ± 10.2</td>
<td>25.9 ± 8.3</td>
</tr>
<tr>
<td>Systemic disease</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Pulp necrosis without periapical lesion</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Pulp necrosis with periapical lesion</td>
<td>23</td>
<td>21</td>
</tr>
<tr>
<td>Mandibular first molar</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Mandibular second molar</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Single session</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Preoperative pain</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

ACRONYMS

VRS: verbal rating scale

Immunocompromised patients who were on antibiotics, analgesics, or corticosteroids preoperatively or during treatment were excluded. Additionally, during the root canal procedure, teeth that could not be treated in a single-session or patients who interrupted treatment were excluded. Table 1 provides information of the study participants.

Randomization was done through a table generated by the Sealed Envelope™ software by a third investigator not involved in the research protocol. A list of 80 numbers was prepared, divided into four blocks, 40 in each group. Each number from the list with the sequence of the experimental and control groups was individually placed in a numbered, opaque, sealed envelope. Once the patient was considered eligible for the procedure, and prior to the endodontic treatment, the envelope was opened by the researcher-operator to identify which individual belonged to which group. Both the patient and researcher-evaluator were blinded to the treatment protocol until the access to the root canal system was performed.

Of the 138 patients considered for the study, 50 were excluded because they did not meet the inclusion criteria. Thus, only 78 individuals were selected for allocation to groups and the individuals were randomly assigned to two groups, that is, 39 patients in the Group Reciproc® (RP) and 39 in ProTaper® group (PT).

Endodontic treatment followed a treatment protocol according to the two techniques used in the study. The cold test was performed by spraying a cotton swab, which was then placed on the occlusal surface of the tooth. If there was no response after five seconds, the test result was considered negative.
The root canals were abundantly irrigated with 2.0 mL of 2.5% sodium hypochlorite after each instrument exchange, and the irrigating solution remained in the root canal during the procedure. For both groups, sodium hypochlorite was applied with the aid of the 30-G Maxi-Probe needle (Dentsply Maillefer) up to 4 mm short of the working length. The amount of irrigating solution did not exceed 40 mL. For all the root canals, patency was performed with a size 10 K-file.

All teeth received the same amount of irrigating solution and the root canals were also irrigated with 17% EDTA prior to obturation. First, the root canals were completely dried using sterile absorbent paper points compatible with the root canal diameters. The gutta-percha master cone, compatible with the root canal instrumentation (ProTaper F1–F4, Dentsply Maillefer or R25–R50, VDW), was then inserted into the root canal and the first 5 mm were coated with AH Plus sealer (Dentsply Maillefer). Obturation was then completed and temporary sealing with glass ionomer cement, occlusal adjustment (completely taken out of occlusion), and final radiography were performed. Patients were referred to their clinic of origin for tooth rehabilitation.

After endodontic treatment, all patients were asked to fill out a verbal description scale according to the operator's instructions (primary outcome). The questionnaires were assessed by the researcher-evaluator who did not have access to the data regarding the type of treatment performed by the operator. To assess postoperative pain, a scale of pain intensity was applied 24 h, 72 h, and 7 days after endodontic treatment. Pain was recorded on a verbal rating scale (VRS) as follows: 0: no pain or discomfort; 1: mild pain: feeling pain, but no oral medication (analgesics) required; 2: moderate pain: feeling pain, but no oral medication (analgesics) required; 3: Severe pain: feeling pain and is no longer able to perform any type of activity, feeling the need to lie down and rest (analgesics have little or no effect on pain relief).

Seven days after the procedure, a postoperative clinical assessment was conducted to assess the condition of the periapical region using palpation and percussion routine tests. The vertical percussion test was recorded as yes or no, depending on the patient’s response to the stimulus. On the second recall visit, all patients returned and pain assessment forms were reviewed.

RESULTS
In the ProTaper® group, 32 (82.0%) patients reported no pain after the first 24 h, 5 (12.8%) experienced mild pain, and 2 (5.1%) reported moderate pain, but none reported severe pain; 37 (94.8%) patients did not present any kind of pain and 2 (5.1%) individuals reported mild pain after 72 h. Seven days after the endodontic treatment, 38 (97.4%) individuals reported no pain and only 1 (2.5%) reported moderate pain. The percussion test was performed on the endodontically treated tooth 7 days after the clinical intervention. Only two individuals responded positively to this test, corresponding to 5.1% of the total sample.

In the Reciproc group, 33 (84.6%) individuals reported no pain after the first 24 h, 3 (7.7%) experienced mild pain, and 3 (7.7%) reported moderate pain, but none reported severe pain; 38 (97.4%) individuals reported no pain and only one (2.5%) reported moderate pain after 72 h; no patients reported any kind of pain 7 days after the endodontic treatment. No patients responded positively to the percussion test 7 days after treatment.

The intensity of pain experienced by patients after endodontic treatment in the Reciproc group was similar to those in the ProTaper group (p > 0.05). In both groups, the highest levels of postoperative pain were recorded 24 h after each procedure, but these levels decreased after 72 h and 7 days after endodontic therapy, although differences were not significant (p = 0.55).

CONCLUSION
No significant difference (p > 0.05) in postoperative pain was found between patients who had been treated using either the ProTaper® or the Reciproc® instrumentation technique during endodontic treatment in this study.

IMPLICATIONS FOR PRACTICE
The occurrence of postoperative pain was low and similar between the reciprocating and rotary techniques during the time intervals assessed in this RCT. These results are different from basic laboratory studies that affirm that the reciprocating techniques tend to promote more postoperative pain since extrusion of debris is greater.

Reference
This edition is accredited for a total of 3 CEUs: 1 ethical plus 2 general CEUs

GENERAL

Determining an average distance from the external mandibular cortex to the inferior alveolar canal using cone beam computed tomography (CBCT) imaging: An aid to harvesting mandibular ramus autogenous grafts. (p 390)
1. This study found that the thickest amount of bone was found at the points anterior to the mandibular foramen.
   a. True
   b. False

Oral Health in South Africa: Exploring the role of dental public health specialists. (p 402)
2. Up to 90% of the South African population is dependent on the public oral health services.
   a. True
   b. False

Comparison of accuracy of digital and conventional radiographies in determining endodontic working length. (p 395)
3. Identify the INCORRECT statement: Digital radiography is recommended by the authors for determination of endodontic working length because:
   a. It is more accurate than conventional radiography.
   b. It offers greater clarity of detail.
   c. It exposes the patient to reduced radiation.
   d. It produces an image more rapidly.
   e. It enables the application of a zoom technique to enhance inspection.

4. It has been shown that the Root ZX*apex (J.Morita, USA) apex locator is accurate in identifying the length of the root canal to within 0.5 mm of the apical constriction at 94.1%.
   a. True
   b. False

Periodontal disease and non-communicable diseases. Strength of bidirectional associations (p 404)
5. Periodontal Disease is considered amongst the top six chronic non-communicable diseases (NCDs).
   a. True
   b. False

6. The clinical association between Periodontal Disease and Cardiovascular Disease has been proven to be independent and clinically significant.
   a. True
   b. False

7. Comprehensive oral/periodontal treatment plans should include preventive dentistry but not controlling lifestyle-associated risk factors (smoking cessation, nutrition, regular exercise).
   a. True
   b. False

8. The global prevalence of ischaemic heart disease, lower respiratory tract infections and stroke has increased.
   a. True
   b. False

9. Susceptibility to periodontitis is increased threefold in diabetics.
   a. True
   b. False

Double Dens In Dente: A rare anomaly. (p 410)
10. Identify the INCORRECT statement: The clinical importance of dens in dente is that it may lead to pulpal involvement as a result of:
   a. Caries developing at a subsurface site.
   b. The enlarged size of the tooth renders it more likely to suffer trauma.
   c. Communications between the dens in dente and the pulp cavity.
   d. The enamel may be hypomineralised allowing bacterial ingress.

Lasers in Paediatric Dentistry. (p 421)
11. Deciduous teeth show a slower rate of ablation under laser treatment.
   a. True
   b. False

12. Erbium lasers allow the operator to remove only diseased tissue.
   a. True
   b. False

   a. True
   b. False
Chronic suppurative osteomyelitis of the maxilla and zygomatic bone: a treatment challenge and the importance of early surgical exploration. (p 412)

14. Identify the INCORRECT statement: Osteomyelitis occurs less frequently in the maxilla than the mandible because:
   a. the rich vascularity and thinner cortices of the maxilla promote rapid healing.
   b. more possibilities for collateral blood supply than exist in the mandible.
   c. Gravitational effects facilitate mandibular infection.
   d. adequate drainage of oedematous fluid and pus into the soft tissues and paranasal sinuses

15. If antibiotic therapy does not resolve the lesion, early exposure to radiotherapy is indicated
   a. True
   b. False

Maxillo-Facial Radiology case 145 (p 425)

16. The jaws are commonly affected in congenital syphilis.
   a. True
   b. False

17. Hutchinson’s teeth are pathognomic of congenital syphilis?
   a. True
   b. False

Clinical Windows (p 426)

18. The mean difference between the two groups in the WeChat trial for the primary outcome was statistically significant
   a. True
   b. False

19. A lower rate of bond failure was observed in WeChat group versus the control group.
   a. True
   b. False

20. In the Relvas et al study, the intensity of pain experienced by patients after endodontic treatment in the Reciproc group was better to those in the ProTaper group.
   a. True
   b. False

ETHICAL
The Ethics of Research: Part 4: Safeguarding the Scientist, Protecting the Participants. (p 422)

21. A practitioner must provide patients with: assurances of confidentiality, education, understandable communication and truthful details before seeking their voluntary consent to treatment.
   a. True
   b. False

22. Clinical research must adhere to the principles of scientific validity, be ethically responsible, ensure that the results are subjected to critical appraisal and peer review, and that the findings made known publically.
   a. True
   b. False

23. Identify the INCORRECT statement. Unethical study design may be the result of:
   a. Poor planning.
   b. Having a pre-meditated assumption or wish as to what results will be obtained.
   c. Not having statistical knowledge, and then failing to consult a statistician.
   d. Adherence to the documented protocol in the face of unexpected results.
   e. Plagiarism.

24. It is unethical to conduct clinical research on new techniques without making provision for follow up treatment or maintenance.
   a. True
   b. False

25. Research involving human subjects should be submitted to a relevant ethical review board for approval.
   a. True
   b. False

Readers will note that we have reduced the number of General Questions to twenty whilst retaining five Ethics based questions. Our allocation of CPD points remains unchanged. There is optimism that this section will continue to provide members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure Continuing Education. Please note that SADA is no longer offering the ‘CPD via SMS’ service.

Contact Ann Bayman at SADA, Tel: 011 484 5288, for any enquiries and assistance.

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Branch: Northern Cape
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Branch: Western Cape
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Branch: DPL Only Member
MRO: Nelisa Makubalo
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Branch: Affiliate (Non Branch Member)
MRO: Anna Tsumane
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If you are not currently a member of SADA/DPL and would like to apply for SADA membership please speak to the MRO relevant to your provincial area.

Continuing Professional Development
If your enquiry is related to a CPD Accreditation Application or CPD Event, please forward your enquiry to CPD@sada.co.za
New LISTERINE® Advanced White
Helping give oral health a brighter future

Unique multi-action formula, proven to improve the appearance of teeth in two weeks

- Helps lift stains
- Helps prevent new stains forming
- Protects against plaque bacteria
- Fluoride helps strengthen teeth

LISTERINE® Advanced White should be used twice daily (10 ml twice daily for 60 seconds) after brushing as an adjunct to mechanical cleaning.

Whitens  Cleanses  Fluoridates
PROVEN TO HELP

Cleans:
Removes more plaque with a single 60 second brushing vs. non-sodium bicarbonate toothpaste

Prevents:
Stops bleeding gums

Keeps gums healthy

Chlorhexidine digluconate


Corsodyl® Mouthwash Original (Solution). Mouthwash containing 2 mg/ml chlorhexidine gluconate with 5.4% m/v ethanol as a preservative. Reg. No.: S/16.4/182.

Corsodyl® Mouthwash Alcohol Free (Solution). Mouthwash containing 2 mg/ml chlorhexidine gluconate.